EXACT
electronics, inc.

MP MASTER
MA27907

INSTRUCTION MANUAL

MODEL 500

FUNCTION GENERATOR

9/16/81

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1/81

® Box 347 Tillamook OR 97141
Telephone 503-842-8441
TWX 510-590-0918
EXACT electronics, inc.

IF YOUR INSTRUMENT DOES NOT OPERATE

PLEASE

1. Check operating procedure in manual for proper setup.
2. Check fuse and power supply voltages.
3. Call your Exact representative or factory. Instruments returned to the factory will be accepted only if they are sent freight prepaid, unless Exact or factory representative has authorized otherwise.

CLAIM FOR DAMAGED SHIPMENT

The instrument should be inspected as soon as received. If damage has occurred, a claim should be made with the carrier. The claim agent should receive a complete report of damage and a copy sent to Exact. After receiving this report, Exact will advise you of the dispostion of the instrument and arrange for its repair or replacement.

WARRANTY

Exact warrants its instruments to be free from defects in material and workmanship under normal use for a period of twelve months from the original date of shipment. Exact's obligation is limited to repair or replacement.

All repairs and replacements made under this warranty are f.o.b. Exact's factory or designated service depot unless otherwise authorized by Exact. This warranty is made on condition that prompt notice of defect is given to Exact, in writing, within the warranty period and that Exact shall have the sole right to determine whether in fact a defect exists.

This warranty does not apply to any instrument which has been repaired or altered by other than Exact's own service representative so as, in Exact's judgment, to adversely affect it, nor which has been subject to misuse, negligence or accident or which has been operated contrary to sound practice or operating instructions.

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SECTION 1

SPECIFICATIONS

SPECIFICATIONS

WAVEFORMS

Sine, triangle, square.

DYNAMIC FREQUENCY RANGE

0.005Hz to 5MHz

FREQUENCY ACCURACY (Linear mode only)

± 5% of full scale

HI OUTPUT

50 Ohm output impedance
20V P-P into an open circuit.
10V P-P into 50 Ohms.

LO OUTPUT

50 Ohm output impedance.
2V P-P into an open circuit.
1V P-P into 50 Ohms.

ATTENUATION

Continously variable from 0dB to > -30dB on both HI and LO OUTPUTS.

DC OFFSET

Variable, switched on or off by detented control.
HI OUTPUT: +10V to -10V open circuit, +5V to -5V into 50 Ohms.
LO OUTPUT: + 1V to - 1V open circuit, +.5V to -.5V into 50 Ohms.

SQUARE WAVE

Rise and fall times: <40nSec.
Overshoot and ringing: < 5% of maximum peak voltage.

SYMMETRY (TIME)

± (1% +10nSec) 1Hz to 5MHz.

SINE DISTORTION

<0.5% 1Hz to 100kHz.
No harmonics <25dB down 100kHz to 5MHz.

SINE FREQUENCY RESPONSE

< ± 0.2dB to 500kHz.
< ± 1.0dB to 5MHz.

TRIANGLE NON-LINEARITY

< 1% (Best straight line method) 1Hz to 100kHz.

SPECIFICATIONS (continued)

SYNC OUTPUT

Square wave, approximately 4V Peak.
50 Ohms output impedance
TTL compatible

VCF RANGE

Approximately 5V input for 10,000:1 logarithmic frequency control (1000:1 linear).

V:f OUTPUT (Voltage proportional to frequency)

Approximately 0 Volts to +5 for a 10,000:1 logarithmic (1000:1 linear) sweep range.

POWER REQUIREMENTS

115 VAC ± 10% (other voltages available).
50Hz to 400Hz.
Approximately 20 Watts.

PHYSICAL CHARACTERISTICS

21.0 cm wide x 8.9 cm high x 28.0 cm deep.
Weight: 2.3 kg.

OPTIONS

A. STEP ATTENUATOR

20dB and 40dB step attenuator.
Mounted in place of LO OUTPUT.

B. ONE DECADE LOW FREQUENCY EXTENSION

.05Hz to 5MHz.

F. VARIABLE SYMMETRY

5:95 to 95:5 variable time symmetry.
Divides frequency by approximately 10.
Cannot be combined with option 02.

K. 600 OHM OUTPUT IMPEDANCE

The following do not apply with 600 Ohm output: Square rise time, overshoot and ringing, sine frequency response, and sine distortion above 100kHz.
HI and LO outputs are replaced with one output from a pair of 5-way binding posts unless the A option is also installed.

L. GATE/TRIGGER

Provides RUN, GATE, and TRIGGER modes.
Haversine is provided along with the standard waveforms.
Gating and triggering is done from a front panel manual pushbutton or a rear panel TRIGGER IN.
TRIGGER IN requires +1.4V to turn-on with a 10K Ohm input impedance.

OPTIONS (continued)

02. START PHASE

Adds variable start/stop phase to the L option. Cannot be combined with option F.

S. SWEEP

Provides internal sweep capability. Modes include: hold at START frequency, hold at STOP frequency, and RUN. Sweep time is adjustable from approximately 10mSec to 1 min. START and STOP frequencies are set independently. Sweeping may be up or down in frequency over the full VCF range; 1000:1 linear, 10,000:1 logarithmic.

Also provided is a sweep output. Approximately 0 to +5V ramp in RUN, 0V in START, and +5V in STOP.

01. SYMMETRICAL SWEEP

Changes the ramp in option S to a time symmetrical triangle.

T. ADJUSTABLE HANDLE/STAND

RACKMOUNTING

Includes hardware to rackmount one instrument in a standard three and one-half inch rack.

DOUBLE RACKMOUNTING

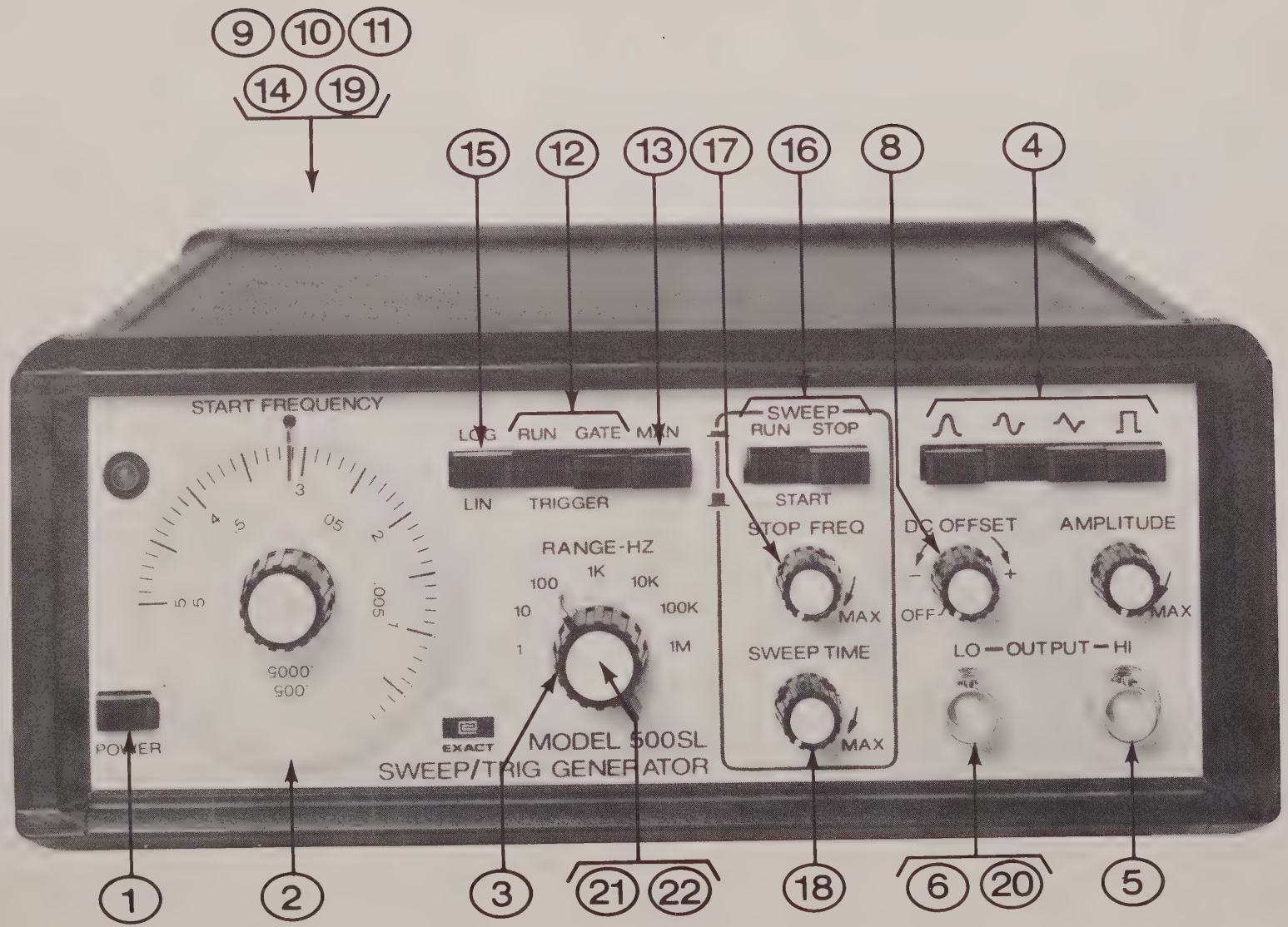
Includes hardware to rackmount two instruments side by side in a standard three and one-half inch rack.

NOTE: Unless otherwise stated, specifications apply 10% to maximum output voltage terminated into 50 Ohms. Specifications are valid for frequency settings between 0.5 and 5.0 on the multiplier dial at 25° C ± 5°C.

Specifications are subject to change without notice.

SECTION 2

OPERATING INSTRUCTIONS



FRONT PANEL FAMILIARITY
MODEL 500SL

OPERATING INSTRUCTIONS

Refer to Figure 2.1 for locations of controls.

1. POWER - Turns on power to the instrument.

2. MULTIPLIER/START FREQUENCY - Sets the frequency at which the generator runs, starting at five times the RANGE-HZ setting and ending .005 times the RANGE-HZ setting.

3. RANGE-HZ - Sets the decade range for the MULTIPLIER/START FREQUENCY control. The actual output frequency is this setting times the MULTIPLIER/START FREQUENCY setting. There are seven ranges from 1Hz to 1MHz. This gives a dynamic frequency range for the instrument of .0001Hz to 5MHz.

4. WAVEFORM - Selects the output waveform. Sine, triangle, and square waves are available.

5. HI OUTPUT - Main output ± 10V open circuit and ±5V into 50 Ohms.

6. LO OUTPUT - Same as HI OUTPUT but ±1V open circuit and ±0.5V into 50 Ohms.

7. AMPLITUDE - Sets the peak to peak amplitude of either output from 0dB to 30dB below the maximum.

8. DC OFFSET - Sets the DC level of the output within the limits of the maximum output levels. This may be shut off by rotating the control counterclockwise through the detent.

9. SYNC OUT - a 0-5V squarewave coincident with the main outputs.

10. VCF IN - Voltage controlled frequency input. Allows for externally selecting the frequency or sweeping. Approximately 0-5 volts covers the range of the MULTIPLIER/START FREQ control.

11. V:f OUT - Provides a voltage proportional to the output frequency. Approximately 0-5V range.

12. RUN/GATE/TRIG - (L option) - Sets the run mode with RUN depressed, the instrument continuously runs at the frequency selected. With GATE depressed and RUN released, the instrument will run continuously as long as a trigger signal is present. With both RUN and GATE released, the instrument outputs one cycle for each trigger signal received.

13. MAN - (L option) - For manually gating or triggering the instruments.

OPERATING INSTRUCTIONS (continued)

14. TRIG IN - (L option) - For externally gating or triggering. When the applied signal goes above 1.4V the instrument is triggered. The signal must go below 1.3V to remove the triggered condition. The voltage should not be allowed to be greater than ± 12V.

15. LOG/LIN - (S option) - Sets the mode of frequency selection in sweep modes.

16. SWEEP RUN/STOP/START - (S option) - With both released, the instrument runs at the frequency set by MULTIPLIER/START FREQ. With SWEEP RUN engaged, the instrument sweeps. With RUN and STOP engaged, the instrument runs at the frequency selected by STOP FREQ.

17. STOP FREQ - (S option) - Sets the frequency that the instrument will be at at the end of a sweep. It covers the same frequency range as MULTIPLIER/START FREQ and may be set either above or below it for sweeping up or down.

18. SWEEP TIME - (S option) - Sets the time to sweep from the MULTIPLIER/START FREQ to the STOP FREQ. The range is approximately 10mSec to 1 min.

19. SWEEP OUT - (S option) - A 0 - 5 volts ramp running at the sweep time rate. When not in the sweep mode, it is at 0V and when in the STOP FREQ mode, it is held at 5V.

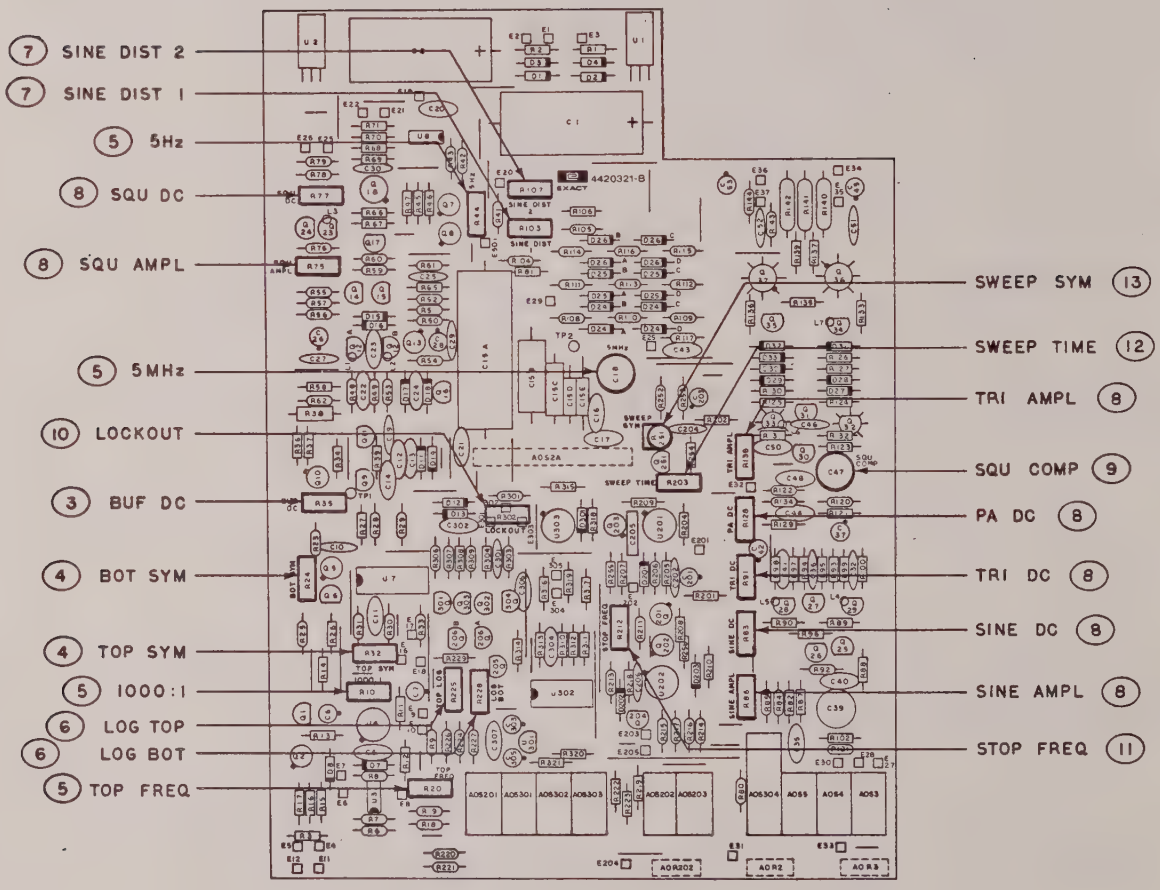
20. STEP ATTENUATOR - (A option) - Provides three attenuation ranges, 0dB, -20dB, and -40dB. The peak voltage in each range is respectively 10V, 1V, and 0.1V. Replaces LO OUTPUT.

21. VARIABLE SYMMETRY - (F option) - Varies the time symmetry of the waveform from 5:95 to 95:5 while dividing the frequency by approximately 10. It is turned off in the detented counterclockwise position. Concentric with RANGE- HZ (3).

22. VARIABLE START/STOP - (02 option) - Combined with L option to vary the start phase of sine and triangle waves from -90° to +90°. Concentric with RANGE-HZ (3).

SECTION 3

CALIBRATION PROCEDURE



ADJUSTMENT LOCATION DETAIL

CALIBRATION PROCEDURE

1. EQUIPMENT REQUIRED

Oscilloscope: 0 - 50MHz with differential comparator input.

Counter-Timer: 1Hz to 5MHz with time interval A to B.

Distortion Analyzer: < 0.1% residual distortion.

2. INITIAL CONTROL SETTINGS

NOTE: This manual is written for all 500 series instruments (500, 500S, 500L, 500SL). Ignore control settings and adjustments that do not apply to your instrument.

LOG/(LIN)	Disengaged
RUN	Engaged
GATE	Disengaged
RANGE-HZ	10K
SWEEP RUN	Disengaged
SWEEP STOP	Disengaged
STOP FREQ	CENTERED
WAVEFORM	
DC OFFSET	OFF
AMPLITUDE	MAX CW

3. BUFFER OFFSET

A. Connect the oscilloscope to TP 1.

B. Adjust BUF DC ADJ for the triangle to be symmetrical about 0V ± 100mV.

4. TIME SYMMETRY

A. Connect HI OUTPUT to counter-timer.

B. Set counter-timer to measure time interval.

C. Set MULTIPLIER/START FREQ for a reading of approximately 15µ Sec.

D. Alternately switch the counter-timer to measure the two halves of the waveform separately (positive slope to negative slope, the negative slope to positive slope).

E. Adjust TOP SYM ADJ for both halves to be the same ± .1% (± 15nSec).

4. TIME SYMMETRY (continued)

F. Set MULTIPLIER/START FREQ for a reading on the counter of approximately 5mSec. If it will not adjust low enough in period, use the 1000:1 ADJ.

G. Adjust BOT SYM ADJ as in step D and E above.

H. Repeat steps C through G until no more improvement can be obtained.

5. FREQUENCY

A. Set MULTIPLIER/START FREQ fully counterclockwise.

B. Set the counter to measure frequency (or period for low frequency adjustment).

C. Adjust 1000:1 ADJ for a frequency of 40Hz ± 4Hz (25mSec ± 2.5mSec).

D. Set MULTIPLIER/START FREQ for a reading of 5kHz. The dial should be set at .5 on the LIN scale (5 minor divisions below 1). Adjust this by loosening the set screws on the dial and rotating it.

E. Set MULTIPLIER/START FREQ to 5.

F. Adjust TIMING ADJ for 50kHz.

G. Repeat steps D through F until both readings are within 1%.

H. Set MULTIPLIER/START FREQ to 5.

I. Set RANGE-HZ to 1.

J. Adjust 5Hz FREQ ADJ for 5Hz ± .5Hz (200mSec ± 2mSec).

K. Set RANGE-HZ to 1M.

L. Adjust 5MHz ADJ for 5MHz ± 50kHz.

6. LOG (S option only)

A. Depress LOG.

B. Set RANGE-HZ to 10K.

C. Adjust LOG TOP for 50kHz ± 500Hz (20μSec ± .2μSec).

D. Turn MULTIPLIER/START FREQ fully counterclockwise.

6. LOG (S option only) (continued)

   E. Adjust LOG BOT for 4Hz ± .4Hz (250mSec ± 25mSec).

   F. Repeat steps C through E until no more improvement can be obtained.

   G. Disengage LOG.

7. SINE DISTORTION

   A. Set WAVEFORM to SINE.

   B. Set RANGE-HZ to 10K.

   C. Set MULTIPLIER/START FREQ to 5.

   D. Connect HI OUTPUT to Distortion Analyzer.

   E. Adjust SINE DIST 1 for minimum distortion.

   F. Adjust SINE DIST 2 for minimum distortion.

   G. Repeat steps E and F until no more improvement can be obtained.

8. OUTPUT LEVELS

   A. Connect HI OUTPUT to oscilloscope terminated in 50 Ohms.

   B. Turn AMPLITUDE fully counterclockwise.

   C. Adjust PA DC for 0V ± 10mV.

   D. Set WAVEFORM to TRIANGLE.

   E. Adjust TRI DC for the triangle peaks to be equal voltages ± 10mV.

   F. Adjust TRI AMPL for the triangle peaks to be 5.1V ± 50mV.

   G. Set WAVEFORM to SINE.

   H. Adjust SINE DC ADJ for both sine peaks to be the same voltage ± 10mV.

   I. Adjust SINE AMPL ADJ for sine peaks of 5.1V ± 50mV.

   J. Set WAVEFORM to SQUARE.

   K. Adjust SQU DC ADJ for the positive peak to be 5.1V ± 50mV.

   L. Adjust SQU AMPL ADJ for the negative peak to be 5.1V ± 50mV.

9. RISE TIME

   A. Set MULTIPLIER/START FREQ to 3.

   B. Set RANGE-HZ to 1M.

   C. Adjust SQU COMP ADJ for rise and fall times less than 40nSec and aberrations less than 5%.

10. START LEVEL (L option only without 02 option)

   A. Engage triangle.

   B. Disengage RUN.

   C. Adjust LOCKOUT ADJ for 0V ± 50mV.

11. SWEEP (S option only)

   A. Engage RUN.

   B. Engage SWEEP RUN.

   C. Engage SWEEP STOP.

   D. Adjust STOP FREQ ADJ for minimum change in frequency when START FREQ is rotated.

   E. Disengage SWEEP STOP.

12. SWEEP TIME (S option without 01 option only)

   A. Connect oscilloscope to sweep out, unterminated.

   B. Turn SWEEP TIME fully clockwise.

   C. Turn SWEEP TIME ADJ fully counterclockwise, then turn it back until the ramp just stops.

13. SWEEP SYMMETRY (S option with 01 option only)

   A. Connect counter to E251.

   B. Turn SWEEP TIME fully counterclockwise.

   C. Alternately switch counter to measure the two halves of the waveform separately.

13. SWEEP SYMMETRY (S option with 01 option only) (continued)

D. Adjust SWEEP SYM for both halves to be the same period.

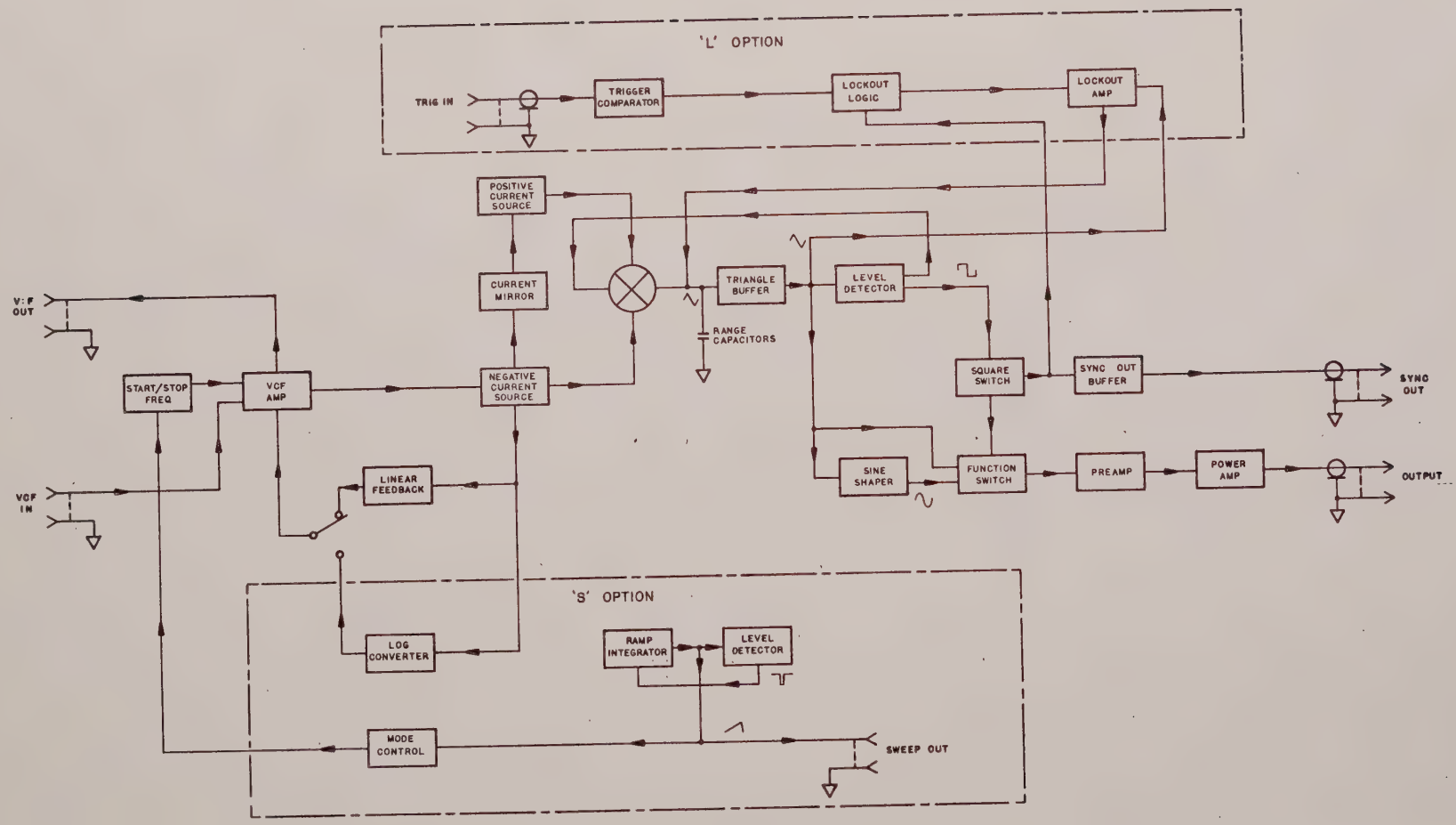
E. Turn SWEEP TIME clockwise until the counter reads approximately 1Sec.

F. Adjust SWEEP TIME ADJ for a symmetrical waveform as in C.

G. Repeat steps B through F.

SECTION 4

CIRCUIT DESCRIPTION



BLOCK DIAGRAM

POWER SUPPLIES

The ± 20 Volt unregulated supplies to power the power amplifier are generated from the transformer T1, full wave bridge D1 through D4 and filter caps C1 and C2. The ± 12 Volt regulated supplies are composed of two terminal regulators U1 and U2 which regulate the ± 20 Volt supplies down to ± 12Volt.

MAIN GENERATOR LOOP

0 to +5VDC is applied at the VCF input R9, or at R8, or R221 from the START FREQ or STOP FREQ controls, respectively. These currents are summed at pin 3 of U4 together with a small current from the 1000:1 calibration adj. The +1 Volt to +7 Volt at the output of U4 is level shifted by Q1 to be -11.5 to -6.5 Volts at the bases of U7A, B, and C. Linear or logarithmic negative feedback from the collector of U7A to the + input of U4 maintains dial linearity or creates the logarithmic response when in the LOG mode. The current through U7B and C tracks that through U7A. U7C is the negative current source for the timing capacitor, while U7B is part of the current mirror for the positive current source. The resistive current divider R18, 19, and 20 provide linear feedback from the collector of U7A to the + input at U4. This divider reduces the current applied to + input of U4 while allowing the collector current of U7A to equal that of the negative current source of U7C. Equalizing these currents provides maximum precision by utilizing equal operating points. When in LOG, the current divider is replaced with an active logarithmic amplifier consisting of Q206A and Q206B and the FET Q205. As with the resistive current divider, the current from U7A is equal to that of U7C, the negative current source, while the current to the + input of U9 is the much lower required value. The positive current source is obtained by the current mirror U7E. Tracking is accomplished with negative feedback provided by Q5 and Q6. U7D provides the positive current source by matching the current in the current mirror. These two current sources are alternately sunk by the level detector, through diode bridge D11, 12, 13, 14, allowing the other source to linearly charge the range selected timing capacitor, C15. Q9, Q10, and Q11 are a unity gain buffer with a very high input impedance. This buffer prevents loading of the current sources to provide a very linear triangle. The input stage, FET Q9, is a source follower, and Q11 is an emitter follower. The Level Detector-Bistable Switch, Q12 is a differential amplifier with Q13 providing a constant current. The reference levels, ± .5V, at the base of Q12B are determined by R53, R54, and R55 depending on the state of diode bridge D17 and D18. D15 and D16 limit the collector voltage excursions to maximize high frequency response. The Level Detector collectors differentially drive a non-saturating current-mode switch, Q14 and Q15. One switch output, Q15, drives the Level Detector reference gate and the Current Source bridge. The SYNC OUTPUT is provided by Q17 level shifting to TTL levels Q18 buffering.

CAPACITANCE MULTIPLIER

U8 is a capacitance multiplier used on the 1Hz range only. It inverts and amplifies the triangle to ± 9V. This is applied to the opposite end of the 10μF timing capacitor and makes it appear to be a 100μF capacitor.

SINE CONVERTER

The Sine Converter converts the triangle to a sinewave with a bipolar diode shaping network. The triangle is applied directly to the three diode bridges, D24, D25, and D26. As the triangle rises, each diode bridge will switch in succession, causing the output of the network to form a sinewave.

PREAMPLIFIER

The preamplifier is a non-inverting closed loop amplifier. Q25 and Q26 form the differential input stage providing DC stability. Q28 forms the second gain stage with Q27 providing the collector of Q28 with a high impedance for increased gain. Q29 buffers the second stage and is the output. Feedback is through R101.

POWER AMPLIFIER

The power amplifier works much like the preamplifier except that it is inverting and the second gain stage is buffered by Q34 and Q35 prior to the output stage Q36 and Q37.

LOCKOUT

The generator is stopped, or locked out by removing the timing current from the timing capacitor C15. Q302 and Q303 form a differential amplifier with the voltage at the base of Q302 being the lockout voltage. The base of Q303 is connected to the output of the triangle buffer. When the triangle reaches the lockout voltage, Q303 is turned on and the timing current is taken away from the capacitor. Q301 is a current source tracking the positive current source keeping the lockout level at the same voltage independent of timing current. Lockout is disabled by pulling the emitters of Q302 and Q303 to 0V. This is done by the lockout flip-flop U302C and D. This is a set-reset type flip-flop receiving signals from the trigger comparator and the level detector to enable and disable lockout. U303 is the trigger comparator. It is a differential comparator set to switch at 1.4V with 100mV of hysteresis. This shapes the incoming trigger signals to levels suitable to drive the flip-flop. U302A and B form a switch debouncer for the manual trigger switch.

SWEEP

The ramp used for sweeping is generated by integrator U201 and level detector U202. The integrating current is supplied by R206 from the SWEEP TIME control. Reset current is supplied by R207. U202 senses when the ramp reaches 5V and switches to turn on the reset current which rapidly returns the ramp to 0V at which time U202 senses this voltage and switches again. Q202 sets the ramp peak voltage and, in the RAMP STOP mode, supplies a voltage equal to the ramp peak.

SECTION 5

PARTS LIST

CODE LIST OF MANUFACTURERS

Code No.	Manufacturer	Address
00000	U.S.A. Common	Any supplier of U.S.
00136	McCoy Electronics	Mount Holly Sprgs, Pa.
00213	Sage Electronics Corp.	Rochester, N.Y.
00334	Humidoil Co.	Colton, Calif.
00373	Westrex Corp.	New York, N.Y.
00378	Garlock Packing Co., Electronic Prod. Div.	Camden, N.J.
00656	Aerovox Corp.	New Bedford, Mass.
00779	Amp, Inc.	Harrisburg, Pa.
00781	Aircraft Radio Corp.	Boonton, N.J.
00815	Northern Eng. Labs, Inc.	Burlington, Wis.
00853	Sangamo Electric Co. Crehill Div. (Capa)	Marion, Illinois
00866	Gse Engineering Co.	Los Angeles, Calif.
00891	Carl E. Holmes Corp.	Los Angeles, Calif.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Calif.
01281	TRW Semiconductors Inc.	Lawndale, Calif.
01295	Texas Instruments, Inc. Transistor Prod. Div.	Dallas, Texas
01349	The Alliance Mfg. Co.	Alliance, Ohio
01561	Chassi-Trak Corp.	Indianapolis, Inc.
01589	Pacific Relays, Inc.	Van Nuys, Calif.
01930	Amerock Corp.	Rockford, Illinois
01961	Pulse Engineering Co.	Santa Clara, Calif.
02114	Ferroxcube Corp/Amer.	Saugerties, N.Y.
02286	Cole Mfg. Co.	Palo Alto, Calif.
02660	Amphenol-Borg El. Corp.	Chicago, Illinois
02735	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N.J.
02771	Vocaline Company of America, Inc.	Old Saybrook, Conn.
02777	Hopkins Engineering Co.	San Fernando, Calif.
03508	G.E. Semiconductor Products Dept.	Syracuse, N.Y.
03705	Apex Machine and Tool Co.	Dayton, Ohio
03797	Eldema Corp.	El Monte, Calif.
03877	Transitron Electronic Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co.	Morristown, N.J.
03954	Air Marine Motors, Inc.	Los Angeles, Calif.
04009	Arrow, Hart and Hegeman Electric Co.	Hartford, Conn.
04013	Taurus Corp.	Lambert-ville, N.J.
04062	Elmenco Products Co.	New York, N.Y.
04222	Hi-Q, Division of Aerovax	Myrtle Beach, S.C.
04298	Elgin National Watch Co. Electronics Div.	Burbank, Calif.
04354	Precision Paper Tube Co.	Chicago, Illinois
04404	Dymec Division of Hewlett-Packard Co.	Palo Alto, Calif.
04651	Sylvania Electric Prod., Inc. Electronic Tube Div.	Mountain View, Calif.
04713	Motorola/Semicon. Prod.	Phoenix, Ari:ona
04732	Filtron Co/Western Div.	Culver City, Calif.
04773	Automatic Electric Co.	Northlake, Illinois
04777	Automatic Elect. Sales Corp.	Northlake, Illinois
04796	Sequoia Wire/Cable Co.	Redwood City, Calif.
04811	Precision Coil Spring Co.	El Monte, Calif.
04870	P.M. Motor Co.	Chicago, Illinois
05006	20th Century Plastics	Los Angeles, Calif.
05277	Westinghouse/Semicon. Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	San Mateo, Calif.
05593	Illumitronic Eng. Co.	Sunnyvale, Calif.
05616	Cosmo Plastic (c/o Electrical Spec. Co.)	Cleveland, Ohio
05624	Barber Colman Co.	Rockford, Illinois
05728	Tiffen Optical Co.	Roslyn Heights, L.I., N.Y.
05729	Metropolitan Telecomm. Corp Metro Cap Div.	Brooklyn, N.Y.
05783	Stewart Engineering Co.	Santa Cruz, Calif.
05820	Wakefield Engineering Inc.	Wakefield, Mass.
06004	The Bassick Co.	Bridgeport, Conn.
06175	Bausch and Lomb Optical	Rochester, N.Y.
06402	E,T,A, Products/Amer.	Chicago, Illinois
06475	Western Devices, Inc.	Inglewood, Calif.
06540	Amatom Elect. Hardware Co.	New Rochelle, N.Y.
06555	Beede Electrical Inst.Co.	Penacook, N.H.
06751	U.S. Semcor Div. of Nuclear Corp/Amer.	Phoenix, Ariz.
06812	Torrington Mfg Co, West Div.	Van Nuys, Calif.
07088	Kelvin Electric Co.	Van Nuys, Calif.
07115	Corning Glass Works Electronics Comp. Dept.	Bradford, Pa.
07126	Digitran Co.	Pasadena, Calif.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp. Electronic Tube Div.	Elmira, N.Y.
07149	Filmohm Corp.	New York, N.Y.
07233	Cinch-Graphik Co.	City of Industry, Calif.
07261	Avnet Corp.	Los Angeles, Calif.
07263	Fairchild Semiconductor Corp.	Mountain View, Calif.
07322	Minnesota Rubber Co.	Minneapolis, Minn.
07387	The Birtcher Corp.	Los Angeles, Calif.
07700	Technical Wire Products	Springfield, N.J.
07910	Continental Device Corp.	Hawthorne, Calif.
07933	Rheem Semiconductor Corp.	Mountain View, Calif.
07966	Shockley Semiconductor Labs	Palo Alto, Calif.
07980	Boonton Radio Corp.	Boonton, N.J.
08145	U.S. Engineering Co.	Los Angeles, Calif.
08289	Bliss, Delbert, Co.	Pomona, Calif.
08358	Burgess Battery Co.	Niagara Falls, Ontario
08717	Sloan Company	Burbank, Calif.
08718	Cannon Elect Co., Phoenix Div	Phoenix, Ariz.
08792	CBS Elect. Semiconductor Oper., Div. C.B.S., Inc.	Lowell, Mass.
08984	Mel-Rain	Indianapolis, Ind.
09026	Babcock Relays, Inc.	Costa Mesa, Calif.
09134	Texas Capacitor Co.	Houston, Texas
09145	Ataben Electronics	Sun Valley, Calif.
09250	[illegible] Assemblies, Inc.	Chicago, Illinois
09569	Mallory Battery Co/Canada Ltd.	Toronto, Ontario, Canada
09664	The Bristol Company	Waterbury, Conn.
10014	Gen. Trans. Western Corp.	Los Angeles, Calif.
10411	Ti-Tal, Inc.	Berkeley, Calif.
10597	Exact Electronics, Inc.	Hillsboro, Oreg.
10646	Carborundum Co.	Niagara Falls, N.Y.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Tel. of Calif., Inc.	S. Pasadena, Calif.
11312	Microwave Elect. Corp.	Palo Alto, Calif.
11534	Duncan Electronic, Inc.	Santa Ana, Calif.
11711	Gen'l Inst/Semiconductor Div	Newark, N.J.
11717	Imperial Electronic, Inc.	Buena Park, Calif.

Code No.	Manufacturer	Address
11870	Melabs, Inc.	Palo Alto, Calif.
12136	Philadelphia Handle Co.	Camden, N.J.
12697	Clarostat Mfg. Co.	Dover, N.H.
12859	Nippon Elect. Co., Ltd.	Tokyo, Japan
12930	Delta Semiconductor Inc.	Newport Beach, Calif.
13103	Thermalloy	Dallas, Texas
13396	Telefunken (G.M.B.H.)	Honnover, Germany
13835	Midland Mfg. Co.	Kansas City, Kansas
14099	Semi-Tech	Newbury Park, Calif.
14193	Calif. Resistor Corp.	Santa Monica, Calif.
14298	American Components Inc.	Conshohocken, Pa.
14655	Cornell Dubilier El. Corp.	So. Plainfield, N.J.
14960	Williams Mfg. Co.	San Jose, Calif.
15203	Webster Elect., Co., Inc.	Brooklyn, N.Y.
15291	Adjustable Bushing Co.	N. Hollywood, Calif.
15772	Twentieth Century Coil Spring Co.	Santa Clara, Calif.
15909	The Daven Co.	Livingston, N.J.
16037	Spruce Pine Mica Co.	Spruce Pine, N.C.
16352	Computer Diode Corp.	Lodi, N.J.
16448	De Jur-Amsco Corp.	Long Island City, N.Y.
16758	Delco Radio, Division of G.M. Corp.	Kokomo, Ind.
17109	Thermonetics, Inc.	Canoga Park, Calif.
17474	Tranex Company	Mountain View, Calif.
18486	Rantec Industries	Des Plaines, Illinois
18583	Curtis Instrument, Inc.	Mt. Kisco, N.Y.
18873	E.I. Dupont and Co., Inc.	Wilmington, Del.
19315	Eclipse Pioneer, Div. of Bendix Aviation Corp.	Teterboro, N.J.
19500	Thomas A. Edison Industries Div. McGraw-Edison Co.	West Orange, N.J.
19701	Electro Manufacturing Co.	Kansas City, Mo.
20183	Electronic Tube Corp.	Philadelphia, Pa.
21226	Executive, Inc.	New York, N.Y.
21520	Forstner Metallurgical Corp.	No. Chicago, Illinois
21335	The Fafnir Bearing Co.	New Britain, Conn.
21964	Fed. Telephone and Radio Corp.	Clifton, N.J.
24446	General Electric Co.	Schenectady, N.Y.
24455	G.E. Lamp Div.	Nela Park, Cleveland, Ohio
24655	General Radio Co.	W. Concord, Mass.
26365	Gries Reproducer Corp.	New Rochelle, N.Y.
26462	Grobet File Co/America, Inc.	Carlstadt, N.J.
26992	Hamilton Watch Co.	Lancaster, Pa.
28480	Hewlett-Packard Co.	Palo Alto, Calif.
33173	GE Receiving Tube Dept.	Owensboro, Ky.
33434	Lectrohm, Inc.	Chicago, Ill.
36196	Stanwyck Corp.	Hawkesburn, Ontario, Cd.
37942	P.R. Mallory and Co., Inc.	Indianapolis, Ind.
39543	Mechanical Industries Prod.	Akron, Ohio
40920	Miniature Precision Bearings	Keene, N.H.
42190	Muter Co.	Chicago, Illinois
43990	C.A. Norgren Co.	Englewood, Colo.
44655	Ohmite Mfg. Co.	Skokie, Illinois
47904	Polaroid Corp.	Cambridge, Mass.
48620	Precision Thermometer/Inst.	Philadelphia, Pa.
49956	Raytheon Company	Lexington, Mass.
52090	Rowan Controller Co.	Baltimore, Md.
63743	Ward Leonard Electric	Mt. Vernon, N.Y.
54294	Shallcross Mfg. Co.	Selma, N.C.
55026	Simpson Electric Co.	Chicago, Illinois
55933	Sonotone Corp.	Elmsford, N.Y.
55938	Sorenson and Co., Inc.	S. Norwalk, Conn.
56-37	Spaulding Fibre Co., Inc.	Tonawanda, N.Y.
56289	Sprague Electric Co.	N. Adams, Mass.
59446	Telex, Inc.	St. Paul, Minn.
59730	Thomas and Betts Co.	Elizabeth, N.J.
60741	Tripplett Electrical Inc.	Bluffton, Ohio
61775	Union Switch and Signal, Div. Westinghouse Air Brake Co.	Swissvale, Pa.
62119	Universal Electric Co.	Owosso, Mich.
63743	Ward-Leonard Electric Co.	Mt. Vernon, N.Y.
64959	Western Electric Co., Inc.	New York, N.Y.
65092	West Inst./Div. Daystrom	Newark, N.J.
66295	Wiltek Manufacturing Co.	Chicago, Illinois
66346	Wollensak Optical Co.	Rochester, N.Y.
70276	Allen Manufacturing Co.	Hartford, Conn.
70309	Allied Control Co., Inc.	New York, N.Y.
70319	Alimetal Screw Prod. Co, Inc.	Garden City, N.Y.
70485	Atlantic India Rubber Works	Chicago, Illinois
70563	Amperite Co., Inc.	New York, N.Y.
70903	Belden Manufacturing Co.	Chicago, Illinois
70998	Bird Electronic Corp.	Cleveland, Ohio
71002	Bimbach Radio Co.	New York, N.Y.
71041	Boston Gear Works Div. of Murray Co. of Texas	Quincy, Mass.
71125	Bud Radio Inc.	Cleveland, Ohio
71286	Camloc Fastener Corp.	Paramus, N.J.
71313	Allen D. Cardwell Elect. Prod. Corp.	Plainville, Conn.
71400	Bussmann Fuse Div. of McGraw-Edison Co.	St. Louis, Mo.
71436	Chicago Condenser Corp.	Chicago, Illinois
71450	CTS Corp.	Elkhart, Ind.
71468	Cannon Electric Co.	Los Angeles, Calif.
71471	Cinema Engineering Co.	Burbank, Calif.
71482	C.P. Clare and Co.	Chicago, Illinois
71590	Centralab, Div. Globe Union, Inc.	Milwaukee, Wis.
71616	Commercial Plastics Co.	Chicago, Illinois
71700	The Cornish Wire Co.	New York, N.Y.
71744	Chicago Miniature Lamp Wks	Chicago, Illinois
71753	A. O. Smith Corp. Crowley Div.	West Orange, N.J.
71785	Cinch Mfg. Corp.	Chicago, Illinois
71984	Dow Corning Corp.	Midland, Mich.
72092	Eitel-McCullough, Inc.	San Bruno, Calif.
72136	Electro Motive Mfg. Co, Inc.	Willimantic, Conn.
71707	Coto Coil, Co., Inc.	Providence, R.I.
72354	John E Fast and Company	Chicago, Illinois
72619	Dialight Corp.	Brooklyn, N.Y.
72656	General Ceramics Corp.	Keasbey, N.J.
72699	General Instrument Corp. Semiconductor Div.	Newark, N.J.
73084	Girard-Hopkins	Oakland, Calif.
72765	Drake Mfg. Co.	Chicago, Illinois
72825	Hugh H. Eby, Inc.	Philadelphia, Pa.
72928	Gudeman Co.	Chicago, Illinois
72965	Robert M. Hadley Co.	Los Angeles, Calif.
72982	Erie Resistor Corp.	Erie, Pa.
73061	Hansen Mfg. Co., Inc.	Princeton, Ind.
73076	H. M. Harper Co.	Chicago, Illinois
73138	Helipot, Div. Beckman Instruments, Inc.	Fullerton, Calif.

Code No.	Manufacturer	Address
73293	Hughes Products Div. of Hughes Aircrsft Co.	Newport Beach, Calif.
73445	Amperex Electronic Co., Div. No. American Philips Co., Inc.	Hicksville, N.Y.
73490	Beckman Helipot Corp.	S. Pasadena, Calif.
73506	Bradley Semiconductor Corp.	Hamden, Conn.
73559	Carling Electric, Inc.	Hartford, Conn.
73682	George K. Garrett Co., Inc.	Philadelphia, Pa.
73734	Federal Screw Prod. Co.	Chicago, Illinois
73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
73793	The General Industries Co.	Elyria, Ohio
73846	Goshen Stamping and Tool	Goshen, Ind.
73899	JFD Electronics Corp.	Brooklyn, N.Y.
73905	Jennings Radio Mfg. Co.	San Jose, Calif.
74276	Signalite, Inc.	Neptune, N.J.
74455	J. H. Winns and Sons	Winchester, Mass.
74861	Industrial Condenser Corp.	Chicago, Illinois
74868	R.F. Prod. Div. of Amphenol-Borg Electronics Corp.	Danbury, Conn.
74970	E.F. Johnson Co.	Waseca, Minn.
75042	International Resistance Co.	Philadelphia, Pa.
75173	Jones, Howard B., Div. of Cinch Mfg. Corp.	Chicago, Illinois
75378	James Knights Co.	Sandwich, Illinois
75382	Kulka Electric Corp.	Mt. Vernon, N.Y.
75818	Lenz Electric Mfg. Co.	Chicago, Illinois
75915	Littlefuse, Inc.	Des Plaines, Illinois
76005	Lord Mfg. Co.	Erie, Pa.
76210	C.W. Marwedel	San Francisco, Calif.
76433	Micamold Electronic Mfg. Corp	Brooklyn, N.Y.
76487	James Millen Mfg. Co., Inc.	Malden, Mass.
76493	J.W. Miller Co.	Los Angeles, Calif.
76530	Monadnock Mills	San Leandro, Calif.
76545	Mueller Electric Co.	Cleveland, Ohio
76854	Oak Manufacturing Co.	Crystal Lake, Illinois
77068	Bendix Pacific Div. of Bendix Corp.	N. Hollywood, Calif.
77075	Pacific Metals Co.	San Francisco, Calif.
77221	Phaostron Instrument and Electronic Co.	S. Pasadena, Calif.
77250	Phoell Manufacturing Co.	Chicago, Illinois
77252	Philadelphia Steel and Wire Corporation	Philadelphia, Pa.
77342	Potter and Brumfield, Div. of American Machine/Foundry	Princeton, Ind.
77630	Radio Condenser Co.	Camden, N.J.
77638	Radio Receptor Co., Inc.	Brooklyn, N.Y.
77764	Resistance Products Co.	Harrisburg, Pa.
77969	Rubbercraft Corp. of Calif.	Torrance, Calif.
78189	Shakeproof, Div. of Illinois Tool Works	Elgin, Illinois
78283	Signal Indicator Corp.	New York, N.Y.
78290	Sprague Products Co.	Fitman, N.J.
78452	Thomson-Bremer and Co.	Chicago, Illinois
78471	Tilley Manufacturing Co.	San Francisco, Calif.
78488	Stackpole Carbon Co.	St. Marys, Pa.
78493	Standard Thomson Corp.	Waltham, Mass.
78553	Tinnerman Products, Inc.	Cleveland, Ohio
78790	Transformer Engineers	Pasadena, Calif.
78947	Ucinite Co.	Newtonville, Mass.
79142	Veeder Root, Inc.	Hartford, Conn.
79231	Wenco Mfg. Co.	Chicago, Illinois
79727	Continental-Wirt Elect. Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corp.	New Rochelle, N.Y.
80091	Mepco, Div. of Sessions Clock Company	Morristown, N.J.
80120	Schnitzer Alloy Products	Elizabeth, N.J.
80130	Times Facsimile Corp.	New York, N.Y.
80131	Electronic Industries Assoc. Any brand tube meeting EIA	Washington D.C. standards.
80207	Unimax Switch, Div. of W L Maxson Corp.	Wallingford, Conn.
80223	United Transformer Corp.	New York, N.Y.
80248	Oxford Electric Corp.	Chicago, Illinois
80294	Bourns Laboratories, Inc.	Riverside, Calif.
80411	Aero, Inc. Subsidiary of Fulton Controls Co.	Columbus, Ohio
80486	All Star Products, Inc.	Columbus, Ohio
80509	Avery Adhesive Label Corp.	Defiance, Ohio
80583	Hammerlund Co., Inc.	Monrovia, Calif.
80640	Stevens, Arnold Co., Inc.	New York, N.Y.
81030	International Instruments, Inc.	Boston, Mass.
81073	Grayhill Co.	New Haven, Conn.
81095	Triad Transformer Corp.	LaGrange, Illinois
81312	Winchester Electronics Co.	Venice, Calif.
81349	Military Specifications	Norwalk, Conn.
81415	Wilkor Products, Inc.	.....
81453	Raytheon Mfg. Co., Industrial Components Div, Industrial Tube Oper.	Cleveland, Ohio Newton, Mass.
81483	International Rectifier Corp.	El Segundo, Calif.
81541	The Alpax Products Co.	Cambridge, Mass.
81860	Barry Controls, Inc.	Watertown, Mass.
82042	Carter Park Co.	Skokie, Illinois
82142	Jeffers Electronics, Div. of Speer Carbon Co.	DuBois, Pa.
82170	Allen B. DuMont Labs, Inc.	Clifton, N.J.
82209	Maguire Industries, Inc.	Greenwich, Conn.
82219	Sylvania Electric Prod., Electronic Tube Div.	Emporium, Pa.
82376	Astron Company	E. Newark, N.J.
82389	Switchcraft, Inc.	Orange, Illinois
82647	Metals and Controls, Inc., Div. Texas Instruments, Spencer Products	Attleboro, Mass.
82866	Research Products Corp.	Madison, Wisc.
82877	Raton Mfg. Co., Inc.	Woodstock, N.Y.
82893	Vector Electronic Co.	Glendale, Calif.
83053	Western Washer Mfr. Co.	Los Angeles, California
83058	Carr Fastener Co.	Cambridge, Mass.
83086	New Hampshire Ball Bearing	Peterborough, N.H.
83125	Pyramid Electric Co.	Darlington, S.C.
83148	Electra Condo Co.	Los Angeles, Calif.
83186	Victory Engineering Corp.	Springfield, N.J.
83298	Bendix Corp/Red Bank Div.	Red Bank, N.J.
83315	Hubbell Corp.	Mundelein, Illinois
83330	Smith, Herman H., Inc.	Brooklyn, N.Y.
83385	Central Screw Co.	Chicago, Illinois
83501	Gavitt Wire and Cable Co., Div. Amerace Corp.	Brookfield, Mass.
83594	Burroughs Corp., Electronic Tube Div.	Plainfield, N.J.
83740	Eveready Battery	New York, N.Y.
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.
83821	Loyd Scruggs Co.	Festus, Mo.
84171	Arco Electronics, Inc.	New York, N.Y.
84396	A.J. Glesener Co., Inc.	San Francisco, Calif.
84411	Good All Electric Mfg. Co.	Ogallala, Neb.
84970	Sarkes Tarzian, Inc.	Bloomington, Ind.
85454	Boonton Molding Co.	Boonton, N.J.
85474	R.M. Bracamonte and Co.	San Francisco, Calif.
85660	Koiled Kords, Inc.	New Haven, Conn.
85911	Seamless Rubber Co.	Chicago, Illinois
86197	Clifton Precision Products	Clifton Heights, Pa.
86579	Precision Rubber Products Corp.	Dayton, Ohio
86684	Radio Corp. of America, RCA Electron Tube Div.	Harrison, N.J.
87216	Philco Corp. (Lansing Div.)	Lansing, Pa.
87473	Western Fibrous Glass Products Co.	San Francisco
87664	Van Waters and Rogers, Inc.	Seattle, Wash.
87930	Tower Mfg. Co.	Providence, R.I.
88140	Cutler-Hammer, Inc.	Lincoln, Illinois
88220	Gould-National Batteries, Inc.	St. Paul, Minn.
88698	General Mills, Inc.	Buffalo, N.Y.
89231	Graybar Electric Co.	Oakland, Calif.
89462	Waldes Kohinoor, Inc.	Cambridge, Mass.
89473	General Electric Distributing Corp.	Schenectady, N.Y.
89636	Carter Parts Div. of Economy Baker Co.	Chicago, Illinois
89665	United Transformer Co.	Chicago, Illinois
90179	U.S. Rubber Co., Mechanical Goods Div.	Passaic, N.J.
90970	Bearing Engineering Co.	San Francisco, Calif.
91260	Connor Spring Mfg. Co.	San Francisco, Calif.
91345	Miller Dial and Nameplate Co.	El Monte, Calif.
91418	Radio Materials Co.	Chicago, Illinois
91506	Augat Brothers', Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Neb.
91662	Elco Corp.	Philadelphia
91737	Gremar Mfg Co., Inc.	Wakefield, Mass.
91929	Minneapolis-Honeywell Regulator Co., Microswitch Div.	Freeport, Illinois
91961	Nelm-Bros. Spring Co.	Oakland, Calif.
92180	Tru-Connector Corp.	Peabody, Mass.
92196	Universal Metal Prod., Inc.	Bassett Puente, Calif.
92367	Elgeet Optical Co., Inc.	Rochester, N.Y.
92607	Tinsulite Insulated Wire Co.	Tarrytown, N.Y.
93332	Sylvania Electric Prod, Inc. Semiconductor Div.	Woburn, Mass.
93369	Robbins and Myers, Inc.	New York, N.Y.
93410	Stevens Mfg. Co., Inc.	Mansfield, Ohio
93788	Howard J. Smith, Inc.	Port Monmouth, N J.
93929	G.V. Controls	Livingston, N.J.
93983	Insuline Corporation of America, Electronic Division	Manchester, N.H.
94137	General Cable Corp.	Bayonne, N.J.
94144	Raytheon Mfg. Co., Industrial Comp. Div. Rec. Tube Div.	Quincy, Mass.
94145	Raytheon Mfg. Co., Semiconductor Div, Calif. St. Plt	Newton, Mass.
94148	Scientific Radio Products	Loveland, Colo.
94154	Tung-Sol Electric, Inc.	Newark, N.J.
94197	Curtis-Wright Corp. Electronics Div.	E. Paterson, N.J.
94222	Southco, Div. S. Chester Corp.	Lester, Pa.
94330	Wire Cloth Products, Inc.	Chicago, Illinois
94682	Worcester Pressed Alum. Corp.	Worcester, Mass.
95023	Philbrick Researchers, Inc.	Boston, Mass.
95236	Allies Products Corp.	Miami, Fla.
95238	Continental Connector Corp.	Woodside, N.Y.
95263	Lescraft Mfg. Co., Inc.	New York, N.Y.
95264	Lerco Electronics, Inc.	Burbank, Calif.
95265	National Coil Co.	Sheridan, Wyo.
95275	Vitraman, Inc.	Bridgeport, Conn.
95348	Gordos Corp.	Bloomfield, N.J.
95354	Methode Mfg. Co.	Chicago, Illinois
95712	Daga Electric Co., Inc.	Franklin, Ind.
95987	Weckesser Co.	Chicago, Illinois
96067	Huggins Laboratories	Sunnyvale, Calif.
96095	Hi-Q Div. of Aerovax	Olean, N.Y.
96256	Thordarson-Meissner, Div. Maguire Industries, Inc.	Mt. Carmel, Ill.
96296	Solar Manufacturing Co.	Los Angeles, Calif.
96330	Carlton Screw Co.	Chicago, Illinois
96341	Microwave Associates, Inc.	Burlington, Mass.
96501	Excel Transformer Co.	Oakland, Calif.
97464	Industrial Retaining Ring Co.	Irvington, N.J
97539	Automatic and Precision Mfg.	Yonkers, N.Y.
97966	CBS Electronics Div. C.B.S., Inc.	Danvers, Mass.
97979	Reon Resistor Corp.	Yonkers, N.Y.
98141	Axel Brothers, Inc.	Jamaica, N.Y.
98159	Rubber Teck, Inc.	Gardena, Calif.
98220	Francis L. Mosley	Pasadena, Calif.
98278	Microdot, Inc.	S. Pasadena, Calif.
98291	Sealectro Corp.	Mamaroneck, N.Y.
98405	Carad Corp.	Redwood City, Calif.
98731	General Mills	Minneapolis, Minn.
98821	North Mills Electric Co.	Mineola, N.Y.
98925	Clevite Transistor Prod. Div. Clevite Corp.	Waltham, Mass.
98978	International Electronic Research Corp.	Burbank, Calif.
99109	Columbia Technical Corp.	New York, N.Y.
99313	Varian Associates	Palo Alto, Calif.
99515	Marshall Industries, Electron Products Division	Pasadena, Calif.
99707	Control Switch Div, Controls Co. of America	El Segundo, Calif
99800	Delevon Electronics Corp.	E. Aurora, N.Y.
99848	Wilco Corporation	Indianapolis, Ind.
99934	Rentzendr, Inc.	Boston, Mass.
99942	Hoffman Semiconductor Div. of Hoffman Electronics Corp.	Evanston, Illinois
99957	Technology Instrument Corp. of California	Newbury Park, Calif.

PART	DESCRIPTION	EXACT NO	MFC
A0 X0001	INSTRUCTION MANUAL	110500	10597
A0 X0002	THRU		
A0 X0005	BNC JACK	1310047	10597
A0 X0006	THRU		
A0 X0008	BANANA JACK, BLUE	1310087	10597
A0 X0009	THRU		
A0 X0011	BANANA JACK, BLACK	1310088	10597
A0 X0012	FUSE HOLDER	1360103	10597
A0 X0013	STRAIN RELIEF	1740007	10597
A0 X0014	POWER CORD	1750203	10597
A0 X0015	THRU		
A0 X0016	HEAT SINK TO-39	2000067	10597
A0 X0017	THRU		
A0 X0018	HEAT SINK TO-92	2000102	10597
A0 X0019	SWITCH CHASSIS	2592200	10597
A0 X0020	THRU		
A0 X0023	KNOB, 1/8"	3660102	10597
A0 X0024	KNOB, 1/4" W/EARS	3660103	10597
A0 X0025	DIAL	3660535	10597
A0 X0026	PANEL, REAR	3890435	10597
A0 X0027	PANEL, FRONT	3890436	10597
A0 X0028	THRU		
A0 X0029	BRACKET, PCB	4060220	10597
A0 X0030	CASE	4380600	10597
A0 X0031	PCB	4420321	10597
A0 D0001	LED	1520002	4713
A0 R0001	POTENTIOMETER, 5K	3110340	10597
A0 R0002	POTENTIOMETER, 10K OHM	3110343	10597
A0 R0003	POTENTIOMETER, 1K OHM	3110342	10597
A0 S0001	SWITCH, POWER	2600375	10597
A0 S0002	SWITCH, RANGE	2600511	10597
A0 S0003	SWITCH, SQUARE	SEE NOTE 1	10597
A0 S0004	SWITCH, TRIANGLE	SEE NOTE 1	10597
A0 S0005	SWITCH, SINE	SEE NOTE 1	10597
A0 S0006	SWITCH, OFFSET	3110343	10597
A0 T0001	TRANSFORMER	1200036	10597
A1 C0001	THRU		
A1 C0002	CAPACITOR, 1000μF 63V	2900053	74840
A1 C0003	THRU		
A1 C0004	UNASSIGNED		
A1 C0005	CAPACITOR, 470pF 50V	2810539	853
A1 C0006	CAPACITOR, 6.8μF 35V	2900073	74840
A1 C0007	CAPACITOR, 6.8μF 35V	2900073	74840
A1 C0008	THRU		
A1 C0009	UNASSIGNED		
A1 C0010	CAPACITOR, .001μF 50V	2830000	91418
A1 C0011	CAPACITOR, 10pF 50V	2810529	853
A1 C0012	CAPACITOR, SEL		

PART	DESCRIPTION	EXACT NO	MFC
A1 C0013	CAPACITOR, SEL		
A1 C0014	CAPACITOR, SEL		
A1 C0015	CAPACITOR, SET	2950014	10597
A1 C0016	CAPACITOR, 39pF 50V	2810531	853
A1 C0017	CAPACITOR, 39pF 50V	2810531	853
A1 C0018	CAPACITOR, 8-50pF	2810022	90201
A1 C0019	CAPACITOR, .001µF 50V	2830000	91418
A1 C0020	CAPACITOR, 47pF 50V	2810532	853
A1 C0021	CAPACITOR, 2pF 50V	2810542	853
A1 C0022	CAPACITOR, 39pF 50V	2810531	853
A1 C0023	CAPACITOR, 2pF 50V	2810542	853
A1 C0024	CAPACITOR, 2pF 50V	2810542	853
A1 C0025	CAPACITOR, .001µF 50V	2830000	91418
A1 C0026	CAPACITOR, 6.8µF 35V	2900073	74840
A1 C0027	CAPACITOR, .001µF 50V	2830000	91418
A1 C0028	CAPACITOR, 6.8µF 35V	2900073	74840
A1 C0029	CAPACITOR, .001µF 50V	2830000	91418
A1 C0030	CAPACITOR, .001µF 50V	2830000	91418
A1 C0031	THRU		
A1 C0034	UNASSIGNED		
A1 C0035	CAPACITOR, SEL		
A1 C0036	CAPACITOR, .001µF 50V	2830000	91418
A1 C0037	CAPACITOR, 6.8µF 35V	2900073	74840
A1 C0038	CAPACITOR, .001µF 50V	2830000	91418
A1 C0039	CAPACITOR, SEL		
A1 C0040	CAPACITOR, 12pF 50V	2810541	853
A1 C0041	CAPACITOR, 5pF 50V	2810501	853
A1 C0042	CAPACITOR, 6.8µF 35V	2900073	74840
A1 C0043	CAPACITOR, 270pF 50V	2810540	853
A1 C0044	CAPACITOR, 10pF 50V	2810529	853
A1 C0045	CAPACITOR, 6.8µF 35V	2900073	74840
A1 C0046	CAPACITOR, .001µF 50V	2830000	91418
A1 C0047	CAPACITOR, 3-12pf	2810039	90201
A1 C0048	CAPACITOR, SEL		
A1 C0049	CAPACITOR, SEL		
A1 C0050	CAPACITOR, 47pF 50V	2810532	853
A1 C0051	CAPACITOR, .001µF 50V	2830000	91418
A1 C0052	CAPACITOR, .001µF 50V	2830000	91418
A1 C0053	CAPACITOR, 6.8µF 35V	2900073	74840
A1 D0001	THRU		
A1 D0004	DIODE, 1N4001	1524001	7263
A1 D0005	THRU		
A1 D0006	UNASSIGNED		
A1 D0007	THRU		
A1 D0008	DIODE, 1N914	1520914	7263
A1 D0009	THRU		
A1 D0010	UNASSIGNED		

PART	DESCRIPTION	EXACT NO	MFC
A1 D0011	THRU		
A1 D0018	DIODE, 1N914	1520914	7263
A1 D0019	THRU		
A1 D0023	UNASSIGNED		
A1 D0024	THRU		
A1 D0026	DIODE, SET	1530914	10597
A1 D0027	THRU		
A1 D0033	DIODE, 1N914	1520914	7263
A1 L0001	THRU		
A1 L0007	FERRITE BEAD	1140034	1121
A1 Q0001	TRANSISTOR, 2N4250	1564250	27104
A1 Q0002	TRANSISTOR, 2N2484	1562484	27104
A1 Q0003	THRU		
A1 Q0004	UNASSIGNED		
A1 Q0005	TRANSISTOR, 2N2484	1562484	27104
A1 Q0006	TRANSISTOR, 2N5485	1565485	27104
A1 Q0007	TRANSISTOR, 2N2484	1562484	27104
A1 Q0008	TRANSISTOR, 2N2484	1562484	27104
A1 Q0009	TRANSISTOR, 2N5485	1565485	27104
A1 Q0010	TRANSISTOR, 2N2484	1562484	27104
A1 Q0011	TRANSISTOR, 2N3646	1563646	27104
A1 Q0012	TRANSISTOR, T1S87	1560087	10597
A1 Q0013	TRANSISTOR, 2N2484	1562484	27104
A1 Q0014	TRANSISTOR, 2N4121	1564121	27104
A1 Q0015	TRANSISTOR, 2N4121	1564121	27104
A1 Q0016	TRANSISTOR, 2N4121	1564121	27104
A1 Q0017	TRANSISTOR, 2N3646	1563646	27104
A1 Q0018	TRANSISTOR, 2N2219	1562219	27104
A1 Q0019	THRU		
A1 Q0022	UNASSIGNED		
A1 Q0023	TRANSISTOR, 2N4121	1564121	27104
A1 Q0024	TRANSISTOR, 2N4121	1564121	27104
A1 Q0025	TRANSISTOR, 2N4258	1564258	27104
A1 Q0026	TRANSISTOR, 2N4258	1564258	27104
A1 Q0027	TRANSISTOR, 2N4121	1564121	27104
A1 Q0028	TRANSISTOR, T1S87	1560087	12944
A1 Q0029	TRANSISTOR, T1S87	1560087	12944
A1 Q0030	TRANSISTOR, 2N4121	1564121	27104
A1 Q0031	TRANSISTOR, 2N4121	1564121	27104
A1 Q0032	TRANSISTOR, 2N4121	1564121	27104
A1 Q0033	TRANSISTOR, T1S87	1560087	12944
A1 Q0034	TRANSISTOR, T1S87	1560087	12944
A1 Q0035	TRANSISTOR, 2N4121	1564121	27104
A1 Q0036	TRANSISTOR, 2N2219	1562219	27104
A1 Q0037	TRANSISTOR, 2N2905	1562219	27104

PART	DESCRIPTION	EXACT NO	MFC
A1 R0001	RESISTOR, 4.7K OHM 1/4W 5%	3070472	77902
A1 R0002	RESISTOR, 4.7K OHM 1/4W 5%	3070472	77902
A1 R0003	RESISTOR, 680 OHM 1/4W 5%	3070681	77902
A1 R0004	THRU		
A1 R0005	UNASSIGNED		
A1 R0006	RESISTOR, 24.3K OHM 1/8W 1%	3182432	77902
A1 R0007	RESISTOR, 10K OHM 1/8W 1%	3181002	77902
A1 R0008	RESISTOR, 31.6K OHM 1/8W 1%	3183162	77902
A1 R0009	RESISTOR, 34.8K OHM 1/8W 1%	3183482	77902
A1 R0010	POTENTIOMETER, 10K OHM	3110150	11237
A1 R0011	RESISTOR, 1M 1/4W 5%	3070105	77902
A1 R0012	RESISTOR, 1K OHM 1/4W 5%	3070102	77902
A1 R0013	RESISTOR, 3.9K OHM 1/4W 5%	3070392	77902
A1 R0014	RESISTOR, 3K OHM 1/4W 5%	3070302	77902
A1 R0015	RESISTOR, 20K OHM 1/4W 5%	3070203	77902
A1 R0016	RESISTOR, 20K OHM 1/4W 5%	3070203	77902
A1 R0017	RESISTOR, 620 OHM 1/4W 5%	3070621	77902
A1 R0018	RESISTOR, 31.6K OHM 1/8W 1%	3183162	77902
A1 R0019	RESISTOR, 1.5K OHM 1/8W 1%	3181501	77902
A1 R0020	POTENTIOMETER, 1K OHM	3110147	11237
A1 R0021	THRU		
A1 R0022	UNASSIGNED		
A1 R0023	RESISTOR, 1K OHM 1/8W 1%	3181001	77902
A1 R0024	POTENTIOMETER, 1K OHM	3110147	11237
A1 R0025	RESISTOR, 1K OHM 1/8W 1%	3181001	77902
A1 R0026	RESISTOR, 2.7K OHM 1/4W 5%	3070272	77902
A1 R0027	RESISTOR, 2K OHM 1/4W 5%	3070202	77902
A1 R0028	RESISTOR, 2K OHM 1/8W 1%	3132001	77902
A1 R0029	RESISTOR, 2K OHM 1/8W 1%	3132001	77902
A1 R0030	RESISTOR, 2K OHM 1/8W 1%	3132001	77902
A1 R0031	RESISTOR, 1.91K OHM 1/8W 1%	3131911	77902
A1 R0032	POTENTIOMETER, 250 OHM	3110145	11237
A1 R0033	RESISTOR, 2K OHM 1/8W 1%	3182001	77902
A1 R0034	RESISTOR, 3.3K OHM 1/4W 5%	3070332	77902
A1 R0035	POTENTIOMETER, 10K OHM	3110150	11237
A1 R0036	RESISTOR, 470 OHM 1/4W 5%	3070471	77902
A1 R0037	RESISTOR, 1K OHM 1/4W 5%	3070102	77902
A1 R0038	RESISTOR, 680 OHM 1/2W 5%	3010681	77902
A1 R0039	RESISTOR, 270 OHM 1/4W 5%	3070271	77902
A1 R0040	UNASSIGNED		
A1 R0041	THRU		
A1 R0042	RESISTOR, 499 OHM 1/8W 1%	3184990	77902
A1 R0043	RESISTOR, 9.09K OHM 1/8W 1%	3189091	77902
A1 R0044	POTENTIOMETER, 1K OHM	3110147	11237
A1 R0045	RESISTOR, 270 OHM 1/4W 5%	3070271	77902
A1 R0046	RESISTOR, 2K OHM 1/4W 5%	3070202	77902
A1 R0047	RESISTOR, 10K OHM 1/4W 5%	3070103	77902

PART	DESCRIPTION	EXACT NO	MFC
A1 R0048	THRU		
A1 R0049	RESISTOR, 499 OHM 1/8W 1%	3184990	77902
A1 R0050	THRU		
A1 R0051	RESISTOR, 10K OHM 1/8W 1%	3181002	77902
A1 R0052	RESISTOR, 2.21K OHM 1/8W 1%	3182211	77902
A1 R0053	RESISTOR, 665 OHM 1/8W 1%	3186650	77902
A1 R0054	RESISTOR, 15K OHM 1/8W 1%	3181502	77902
A1 R0055	RESISTOR, 3.92K OHM 1/8W 1%	3183921	77902
A1 R0056	RESISTOR, 3.92K OHM 1/8W 1%	3183921	77902
A1 R0057	RESISTOR, 402 OHM 1/8W 1%	3184020	77902
A1 R0058	RESISTOR, 1.5K OHM 1/8W 1%	3181501	77902
A1 R0059	RESISTOR, 619 OHM 1/8W 1%	3186190	77902
A1 R0060	RESISTOR, 432 OHM 1/8W 1%	3184320	77902
A1 R0061	RESISTOR, 909 OHM 1/8W 1%	3189090	77902
A1 R0062	RESISTOR, 6.81K OHM 1/8W 1%	3186811	77902
A1 R0063	THRU		
A1 R0064	UNASSIGNED		
A1 R0065	RESISTOR, 2K OHM 1/4W 5%	3070202	77902
A1 R0066	RESISTOR, 820 OHM 1/4W 5%	3070821	77902
A1 R0067	RESISTOR, 47 OHM 1/4W 5%	3070470	77902
A1 R0068	RESISTOR, 1.5K OHM 1/4W 5%	3070152	77902
A1 R0069	RESISTOR, 47 OHM 1/4W 5%	3070470	77902
A1 R0070	RESISTOR, 1.2K OHM 1/4W 5%	3070122	77902
A1 R0071	RESISTOR, 47 OHM 1/4W 5%	3070470	77902
A1 R0072	THRU		
A1 R0074	UNASSIGNED		
A1 R0075	POTENTIOMETER, 500 OHM	3110142	11237
A1 R0076	RESISTOR, 1.91K OHM 1/8W 1%	3181911	77902
A1 R0077	POTENTIOMETER, 1K OHM	3110147	11237
A1 R0078	RESISTOR, 4.02K OHM 1/8W 1%	3114201	77902
A1 R0079	RESISTOR, 442 OHM 1/8W 1%	3114420	77902
A1 R0080	RESISTOR, 4.99K OHM 1/8W 1%	3114991	77902
A1 R0081	RESISTOR, 1K OHM 1/4W 5%	3070102	77902
A1 R0082	RESISTOR, 15K OHM 1/4W 5%	3070153	77902
A1 R0083	POTENTIOMETER, 10K OHM	3110150	11237
A1 R0084	RESISTOR, 88.7 OHM 1/8W 1%	3180887	77902
A1 R0085	RESISTOR, 100 OHM 1/8W 1%	3181000	77902
A1 R0086	POTENTIOMETER, 100 OHM	3110141	11237
A1 R0087	RESISTOR, SEL		
A1 R0088	RESISTOR, 330 OHM 1/4W 5%	3070331	77902
A1 R0089	RESISTOR, 5.6K OHM 1/4W 5%	3070562	77902
A1 R0090	RESISTOR, 100K OHM 1/4W 5%	3070104	77902
A1 R0091	POTENTIOMETER, 10K OHM	3110150	11237
A1 R0092	RESISTOR, 1K OHM 1/8W 1%	3181001	77902
A1 R0093	RESISTOR, 10K OHM 1/4W 5%	3070103	77902
A1 R0094	RESISTOR, 100 OHM 1/4W 5%	3070101	77902

PART	DESCRIPTION	EXACT NO	MFC
A1 R0095	RESISTOR, 10K OHM 1/4W 5%	3070103	77902
A1 R0096	RESISTOR, 5.6K OHM 1/4W 5%	3070562	77902
A1 R0097	RESISTOR, 1.3K OHM 1/4W 5%	3070132	77902
A1 R0098	RESISTOR, 100 OHM 1/4W 5%	3070101	77902
A1 R0099	RESISTOR, 1.3K OHM 1/4W 5%	3070132	77902
A1 R0100	RESISTOR, 20 OHM 1/4W 5%	3070200	77902
A1 R0101	RESISTOR, 1K OHM 1/8W 1%	3181001	77902
A1 R0102	RESISTOR, 1.3K OHM 1/4W 5%	3070132	77902
A1 R0103	POTENTIOMETER, 100 OHM	3110141	11237
A1 R0104	RESISTOR, 100 OHM 1/8W 1%	3181000	77902
A1 R0105	RESISTOR, 15 OHM 1/8W 1%	3180150	77902
A1 R0106	RESISTOR, 3.9K OHM 1/4W 5%	3070392	77902
A1 R0107	POTENTIOMETER, 10K OHM	3110150	11237
A1 R0108	THRU		
A1 R0109	RESISTOR, 8.45K OHM 1/8W 1%	3188451	77902
A1 R0110	RESISTOR, 309 OHM 1/8W 1%	3183090	77902
A1 R0111	THRU		
A1 R0112	RESISTOR, 9.76K OHM 1/8W 1%	3189761	77902
A1 R0113	RESISTOR, 200 OHM 1/8W 1%	3182000	77902
A1 R0114	THRU		
A1 R0115	RESISTOR, 19.6K OHM 1/8W 1%	3181962	77902
A1 R0116	RESISTOR, 127 OHM 1/8W 1%	3181270	77902
A1 R0117	RESISTOR, 63.4 OHM 1/8W 1%	3180634	77902
A1 R0118	THRU		
A1 R0119	UNASSIGNED		
A1 R0120	RESISTOR, 1K OHM 1/8W 1%	3181001	77902
A1 R0121	RESISTOR, 2.4K OHM 1/4W 5%	3070242	77902
A1 R0122	RESISTOR, 4.53K OHM 1/8W 1%	3184531	77902
A1 R0123	RESISTOR, 1.1K OHM 1/4W 5%	3070112	77902
A1 R0124	RESISTOR, 2.2K OHM 1/4W 5%	3070222	77902
A1 R0125	RESISTOR, 360 OHM 1/4W 5%	3070361	77902
A1 R0126	RESISTOR, 3K OHM 1/4W 5%	3070302	77902
A1 R0127	RESISTOR, 3.3K OHM 1/4W 5%	3070332	77902
A1 R0128	POTENTIOMETER, 10K OHM	3110150	11237
A1 R0129	RESISTOR, 100K OHM 1/4W 5%	3110104	77902
A1 R0130	RESISTOR, 130 OHM 1/4W 5%	3110131	77902
A1 R0131	RESISTOR, 100 OHM 1/4W 5%	3110101	77902
A1 R0132	RESISTOR, 130 OHM 1/4W 5%	3110131	77902
A1 R0133	RESISTOR, 20 OHM 1/4W 5%	3110200	77902
A1 R0134	RESISTOR, 4.02K OHM 1/8W 1%	3184021	77902
A1 R0135	RESISTOR, 390 OHM 1/4W 5%	3070391	77902
A1 R0136	RESISTOR, 20 OHM 1/4W 5%	3070200	77902
A1 R0137	RESISTOR, 10 OHM 1/4W 5%	3070100	77902
A1 R0138	POTENTIOMETER, 2.5K OHM	3110148	11237
A1 R0139	RESISTOR, 10 OHM 1/4W 5%	3070100	77902
A1 R0140	THRU		
A1 R0142	RESISTOR, 150 OHM 1/2W 1%	3101500	77902
A1 R0143	RESISTOR, 499 OHM 1/8W 1%	3184990	77902
A1 R0144	RESISTOR, 54.9 OHM 1/8W 1%	3180549	77902

PART	DESCRIPTION	EXACT NO	MFC
A1 U0001	INTEGRATED CIRCUIT, MC7812CP	1587812	27104
A1 U0002	INTEGRATED CIRCUIT, MC7912CP	1587912	27104
A1 U0003	INTEGRATED CIRCUIT, μA741CP	1580010	27104
A1 U0004	INTEGRATED CIRCUIT, CA3140	1583140	18722
A1 U0005	THRU		
A1 U0006	UNASSIGNED		
A1 U0007	INTEGRATED CIRCUIT, CA3096AE	1587096	18722
A1 U0008	INTEGRATED CIRCUIT, μA741CP	1580010	27104
	S OPTION (SWEEP)		
A0 R0201	POTENTIOMETER, 1K LOG	3110332	10597
A0 R0202	POTENTIOMETER, 1K	3110342	10597
A0 S0201	SWITCH, LIN/LOG	SEE NOTE 1	
A0 S0202	SWITCH, SWEEP RUN	SEE NOTE 1	
A0 S0203	SWITCH, SWEEP STOP	SEE NOTE 1	
A1 C0201	CAPACITOR, 6.8μF 35V	290073	74840
A1 C0202	CAPACITOR, .001μF 50V	2830000	91418
A1 C0203	CAPACITOR, 6.8μF 35V	2900073	74840
A1 C0204	CAPACITOR, .001μF 50V	2830000	91418
A1 C0205	CAPACITOR, .1μF MYLAR	2900070	15112
A1 C0206	CAPACITOR, .001μF 50V	2830000	91418
A1 D0201	DIODE, FDH333	1520333	7263
A1 D0202	DIODE, 1N914	1520914	7263
A1 D0203	DIODE, 1N753	1520753	7263
A1 Q0201	TRANSISTOR, 2N2484	1562484	27104
A1 Q0202	TRANSISTOR, 2N2484	1562484	27104
A1 Q0203	TRANSISTOR, 2N2484	1562484	27104
A1 Q0204	TRANSISTOR, 2N3646	1563646	27104
A1 Q0205	TRANSISTOR, 2N5485	1565485	27104
A1 Q0206	TRANSISTOR, SET	1574250	10597
A1 R0201	RESISTOR, 20 OHM 1/4W 5%	3070200	77902
A1 R0202	RESISTOR, 20 OHM 1/4W 5%	3070200	77902
A1 R0203	POTENTIOMETER, 10K OHM	3110150	11237
A1 R0204	RESISTOR, 1M OHM 1/4W 5%	3070105	77902
A1 R0205	RESISTOR, 3K OHM 1/4W 5%	3070302	77902
A1 R0206	RESISTOR, 200K OHM 1/8W 1%	3182003	77902
A1 R0207	RESISTOR, 20K OHM 1/4W 5%	3070203	77902
A1 R0208	RESISTOR, 4.7K OHM 1/4W 5%	3070472	77902
A1 R0209	RESISTOR, 1K OHM 1/4W 5%	3070102	77902
A1 R0210	RESISTOR, 12K OHM 1/4W 5%	3070123	77902
A1 R0211	RESISTOR, 3.92K OHM 1/8W 1%	3183921	77902
A1 R0212	POTENTIOMETER, 2.5K OHM	3110148	11237
A1 R0213	RESISTOR, 4.22K OHM 1/8W 1%	3184221	77902
A1 R0214	RESISTOR, 3.01K OHM 1/8W 1%	3183011	77902
A1 R0215	RESISTOR, 1.5K OHM 1/8W 1%	3181501	77902

PART	DESCRIPTION	EXACT NO	MFC
A1 R0216	RESISTOR, 3.01K OHM 1/8W 1%	3183011	77902
A1 R0217	RESISTOR, 1.5K OHM 1/8W 1%	3181501	77902
A1 R0218	RESISTOR, 3K OHM 1/4W 5%	3070302	77902
A1 R0219	RESISTOR, 1.2K OHM 1/4W 5%	3070122	77902
A1 R0220	RESISTOR, 10K OHM 1/8W 1%	3181002	77902
A1 R0221	RESISTOR, 31.6K OHM 1/8W 1%	3183162	77902
A1 R0222	RESISTOR, 620 OHM 1/4W 5%	3070621	77902
A1 R0223	RESISTOR, 10 OHM 1/4W 5%	3070100	77902
A1 R0224	RESISTOR, 249K OHM 1/8W 1%	3182493	77902
A1 R0225	POTENTIOMETER, 10K OHM	3110150	11237
A1 R0226	RESISTOR, 124K OHM 1/8W 1%	3181243	77902
A1 R0227	RESISTOR, 1.5K OHM 1/8W 1%	3181501	77902
A1 R0228	POTENTIOMETER, 1K OHM	3110147	11237
A1 R0229	RESISTOR, 27K OHM 1/4W 5%	3070273	77902
A1 U0201	INTEGRATED CIRCUIT, CA3140	1583140	18722
A1 U0202	INTEGRATED CIRCUIT, MA710	1580020	12944

OPTION 01 (SYMMETRICAL SWEEP)

A1 Q0251	TRANSISTOR, 2N4121	1564121	27104
A1 R0206	RESISTOR, 57.6K OHM 1/8W 1%	3185762	77902
A1 R0251	POTENTIOMETER, 500 OHM	3110142	11237
A1 R0252	RESISTOR, 715 OHM 1/4W 1%	3137150	77902
A1 R0253	RESISTOR, 2.43K OHM 1/8W 1%	3182431	77902
A1 R0254	RESISTOR, 2K OHM 1/4W 5%	3070202	77902
A1 R0255	RESISTOR, 10K OHM 1/4W 5%	3070103	77902
A1 R0256	RESISTOR, 4.7K OHM 1/4W 5%	3070472	77902

OPTION L (GATE/TRIGGER)

A0 S0301	SWITCH RUN	SEE NOTE 1	10597
A0 S0302	SWITH GATE	SEE NOTE 1	10597
A0 S0303	SWITCH MAN	SEE NOTE 1	10597
A0 S0304	SWITCH SINE 2	SEE NOTE 1	10597
A1 C0301	CAPACITOR, .001μF 50V	2830000	91418
A1 C0302	CAPACITOR, 100pF 50V	2810537	853
A1 C0303	CAPACITOR, 6.8μF 35V	2900073	74840
A1 C0304	CAPACITOR, 100pF 50V	2810537	853
A1 C0305	CAPACITOR, 6.8μF 35V	2900073	91418
A1 C0306	CAPACITOR, 30pF 50V	2810553	853
A1 C0307	CAPACITOR, 30pF 50V	2810553	853
A1 D0301	DIODE, 1N757	1520753	7263
A1 Q0301	TRANSISTOR, 2N4250	1564250	27104
A1 Q0302	TRANSISTOR, 2N4258	1564250	27104
A1 Q0303	TRANSISTOR, 2N4258	1564250	27104
A1 Q0304	TRANSISTOR, 2N3646	1563646	27104

PART	DESCRIPTION	EXACT NO	MFC
A1 R0301	RESISTOR, 21.5K OHM 1/8W 1%	3182152	77902
A1 R0302	POTENTIOMETER, 1K OHM	3110147	11237
A1 R0303	RESISTOR, 5.62K OHM 1/8W 1%	3185621	77902
A1 R0304	RESISTOR, 100 OHM 1/4W 5%	3070100	77902
A1 R0305	UNASSIGNED		
A1 R0306	RESISTOR, 1K OHM 1/8W 1%	3181001	77902
A1 R0307	RESISTOR, 21.5K OHM 1/8W 1%	3182152	77902
A1 R0308	RESISTOR, 470 OHM 1/4W 5%	3070471	77902
A1 R0309	RESISTOR, 3.01K OHM 1/8W 1%	3183011	77902
A1 R0310	RESISTOR, 1K OHM 1/4W 5%	3070102	77902
A1 R0311	RESISTOR, 3K OHM 1/4W 5%	3070302	77902
A1 R0312	RESISTOR, 4.7K OHM 1.4W 5%	3070472	77902
A1 R0313	RESISTOR, 4.7K OHM 1/4W 5%	3070472	77902
A1 R0314	RESISTOR, 3K OHM 1/4W 5%	3070302	77902
A1 R0315	RESISTOR, 100K OHM 1/4W 5%	3070104	77902
A1 R0316	RESISTOR, 3K OHM 1/4W 5%	3070302	77902
A1 R0317	RESISTOR, 10K OHM 1/4W 5%	3070103	77902
A1 R0318	RESISTOR, 82K OHM 1/4W 5%	3070823	77902
A1 R0319	RESISTOR, 10K OHM 1/4W 5%	3070103	77902
A1 R0320	RESISTOR, 10K OHM 1/4W 5%	3070103	77902
A1 R0321	RESISTOR, 10K OHM 1/4W 5%	3070103	77902
A1 U0301	INTEGRATED CIRCUIT, LM78L05	1587895	27104
A1 U0302	INTEGRATED CIRCUIT, 7400	1580011	12944
A1 U0303	INTEGRATED CIRCUIT, μA710	1580020	12944
	OPTION 02 (START PHASE)		
A0 R0302	POTENTIOMETER, 10K OHM	3110385	10597
A1 R0301	RESISTOR, 30.1K OHM 1/8W 1%	3183012	77902
A1 R0303	DELETE		
	OPTION F (SYMMETRY)		
A0 C0401	CAPACITOR, 120pF	2810534	853
A0 C0402	CAPACITOR, 120pF	2810534	853
A0 R0401	POTENTIOMETER, 40K OHM	3110386	10597
A0 S0401	SWITCH, SPST	3110386	10597
	OPTION B (LOW FREQUENCY)		
A1 C0501	CAPACITOR, 100μF	2900051	10597

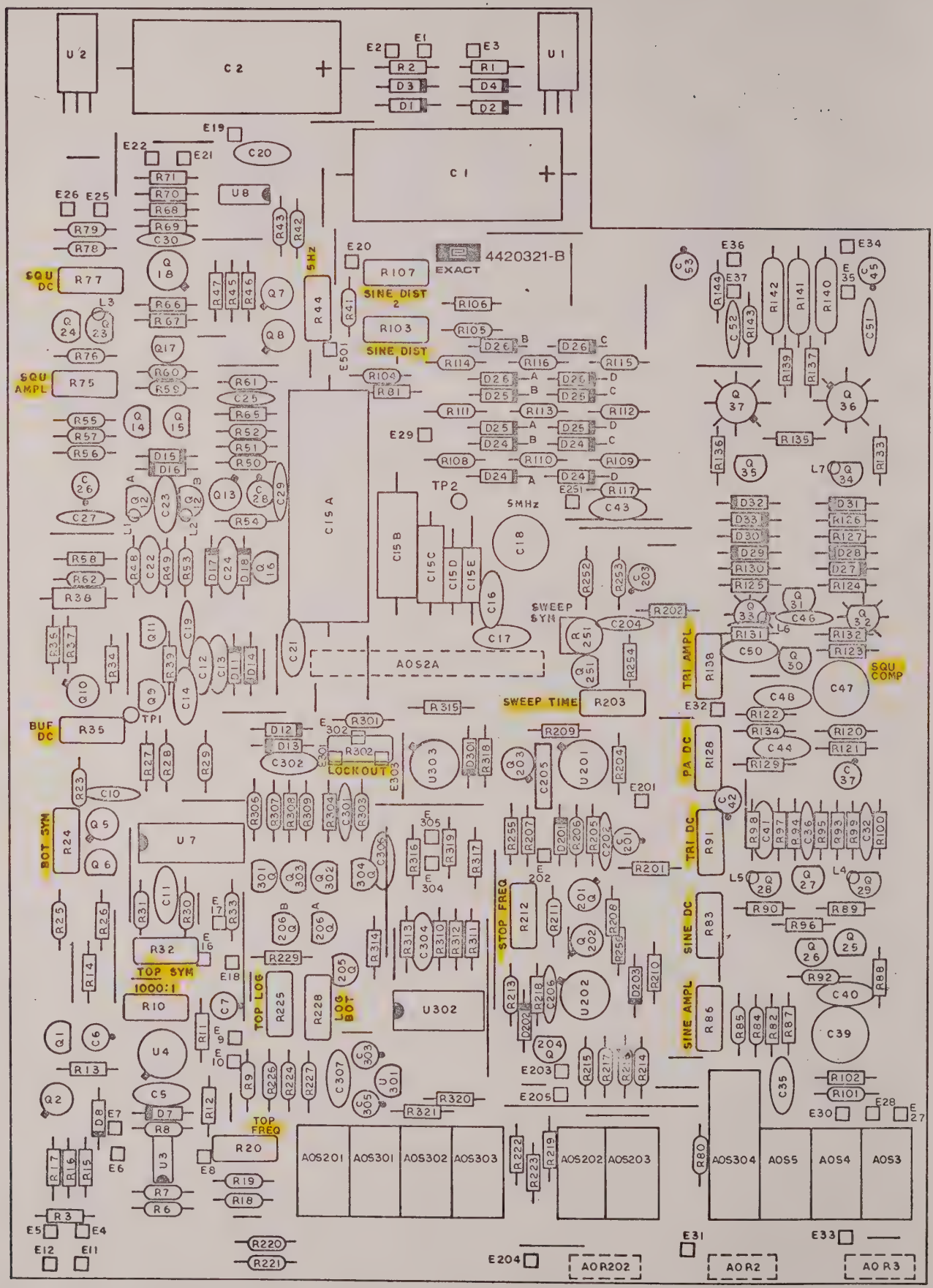
PART	DESCRIPTION	EXACT NO	MFC
	OPTION A (STEP ATTENUATOR)		
A0 R0601	RESISTOR, 453 OHM 1/4W 1%	3134530	77902
A0 R0602	RESISTOR, 56.2 OHM 1/8W 1%	3180562	77902
A0 R0603	RESISTOR, 41.2 OHM 1/8W 1%	3180412	77902
A0 R0604	RESISTOR, 10 OHM 1/8W 1%	3180100	77902
A0 R0605	RESISTOR, 41.2 OHM 1/8W 1%	3180412	77902
A0 S0601	SWITCH, ATTENUATOR	2600090	76854
	OPTION K (600 OHM OUTPUT)		
A0 R0140	RESISTOR, 604 OHM 1/4W 1%	3186040	77002
A0 R0141	RESISTOR, DELETE		
A0 R0142	RESISTOR, DELETE		
A0 R0143	RESISTOR, 6.04K OHM 1/8W 1%	3186041	77002
A0 R0144	RESISTOR, 665 OHM 1/8W 1%	3186650	77002

NOTES:

1. ALL PUSHBUTTON SWITCHES ARE PART OF SWITCH ASSEMBLY 2600510

SECTION 6

SCHEMATICS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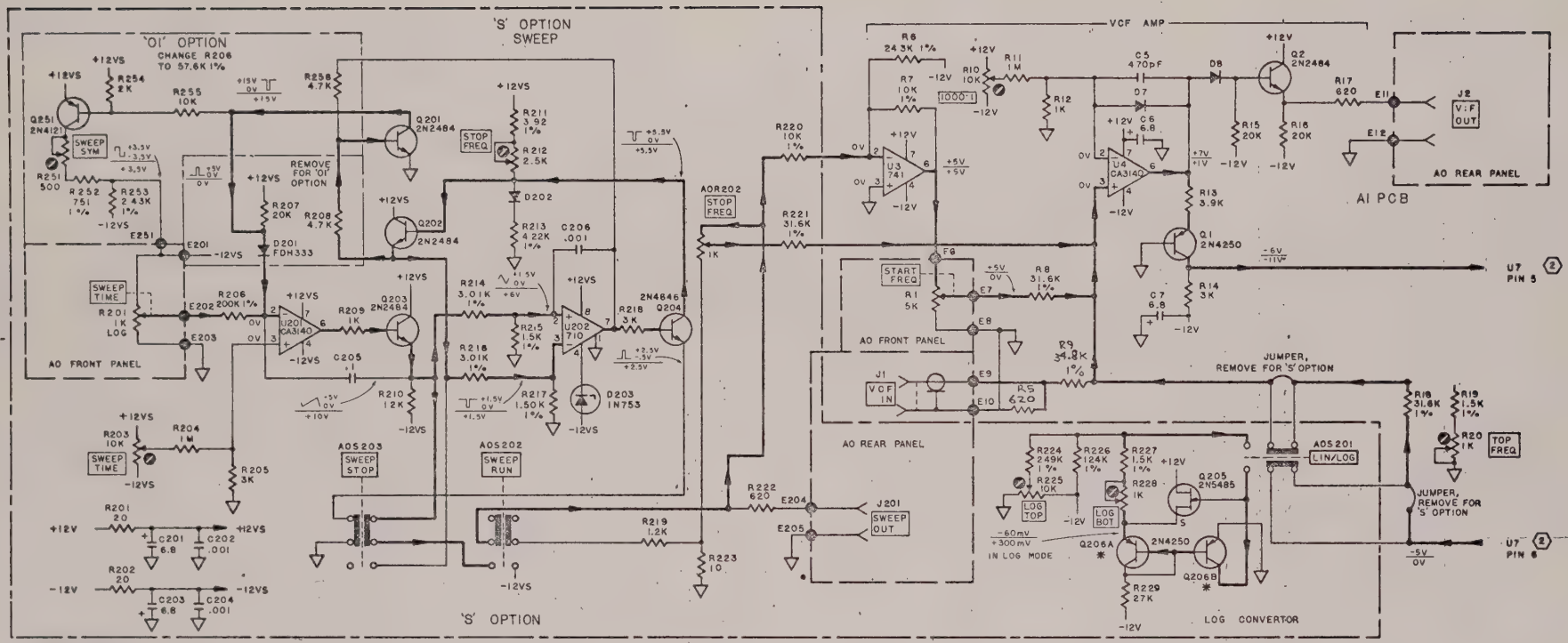
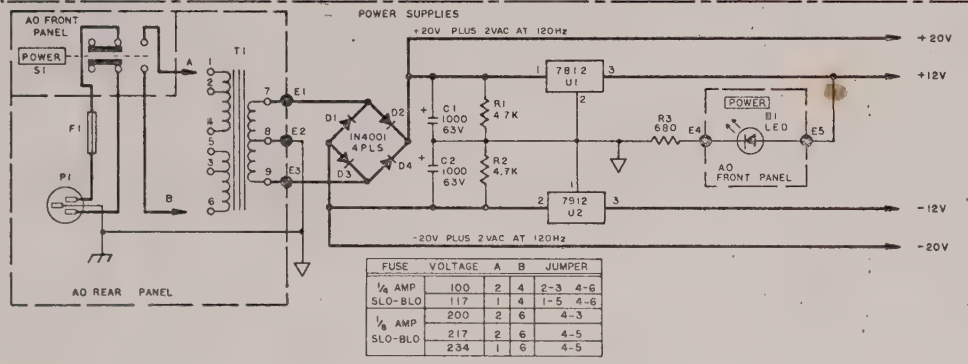
SQU DC
SQU AMPL
SINE DIST 2
SINE DIST
5Hz
5MHz
SWEEP SYN
SWEEP TIME
TRI AMPL
PA DC
TRI DC
SINE DC
SINE AMPL
SQU COMP
BUF DC
BOT SYN
TOP SYM
1000:1
TOP LOG
LOG BOT
TOP FREQ
STOP FREQ
LOCKOUT
A0S2A
A0S201
A0S301
A0S302
A0S303
A0S202
A0S203
A0S304
A0S5
A0S4
A0S3
A0R202
A0R2
A0R3





FUSE	VOLTAGE	A	B	JUMPER
1/4 AMP SLO-BLO	100	2	4	2-3 4-6
	117	1	4	1-5 4-6
1/8 AMP SLO-BLO	200	2	6	4-3
	217	2	6	4-5
	234	1	6	4-5

NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL RESISTORS ARE IN OHMS AND ARE 1/4W 5%
2. ALL CAPACITORS ARE IN MICROFARADS
3. ALL DIODES ARE IN914
4. SEL IS SELECTED AT FACTORY
5. * DENOTES MATCHED SET
6. PARTIAL REF. DES. SHOWN FOR COMPLETE DES. PREFACE WITH SUBASSEMBLY CODE
7. VOLTAGES

EXCEPT S OPTION

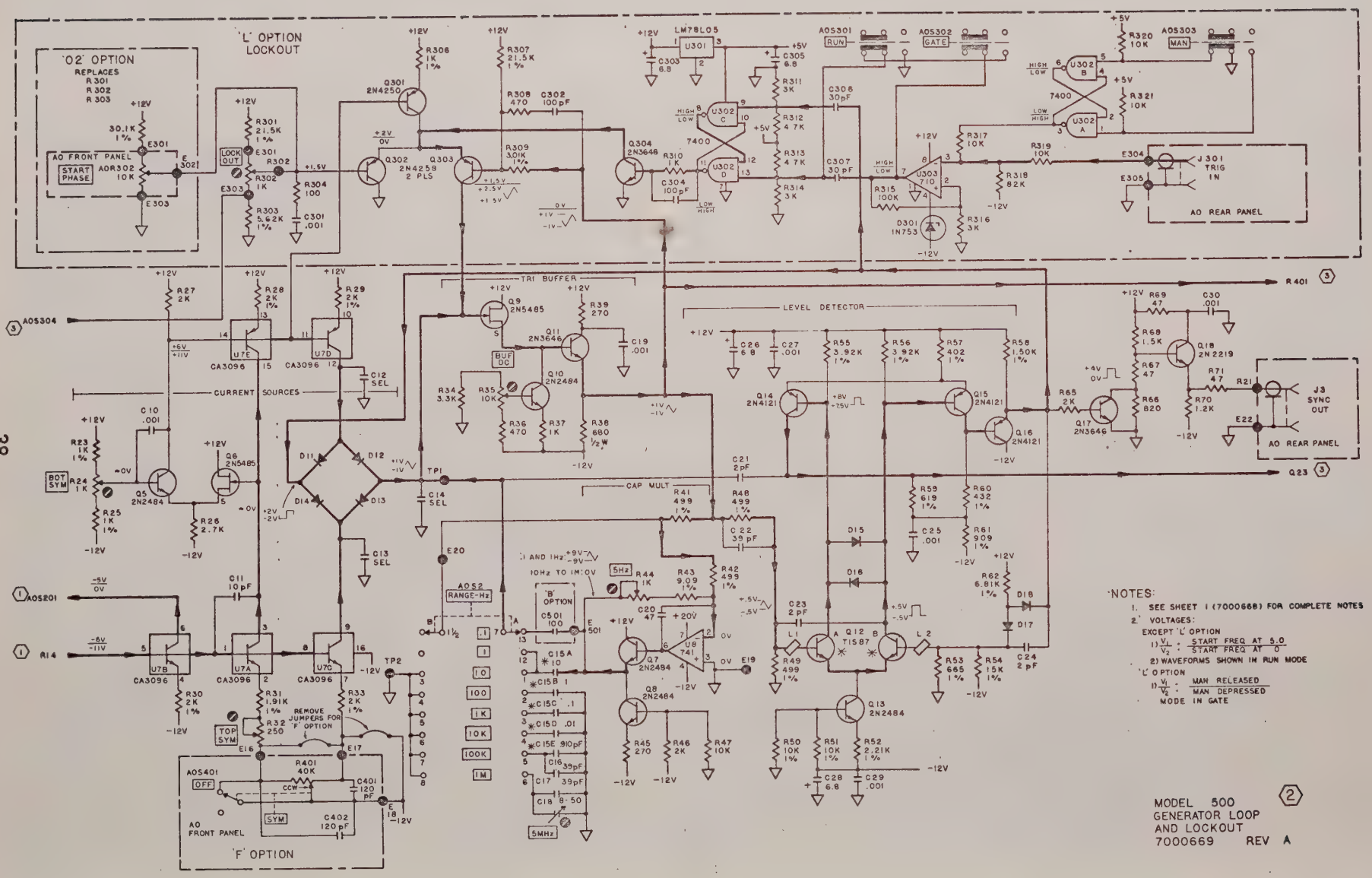
1) $\frac{V_1 : \text{START FREQ AT } 5.0}{V_2 : \text{START FREQ AT } 0}$

NOT IN SWEEP MODE

S OPTION

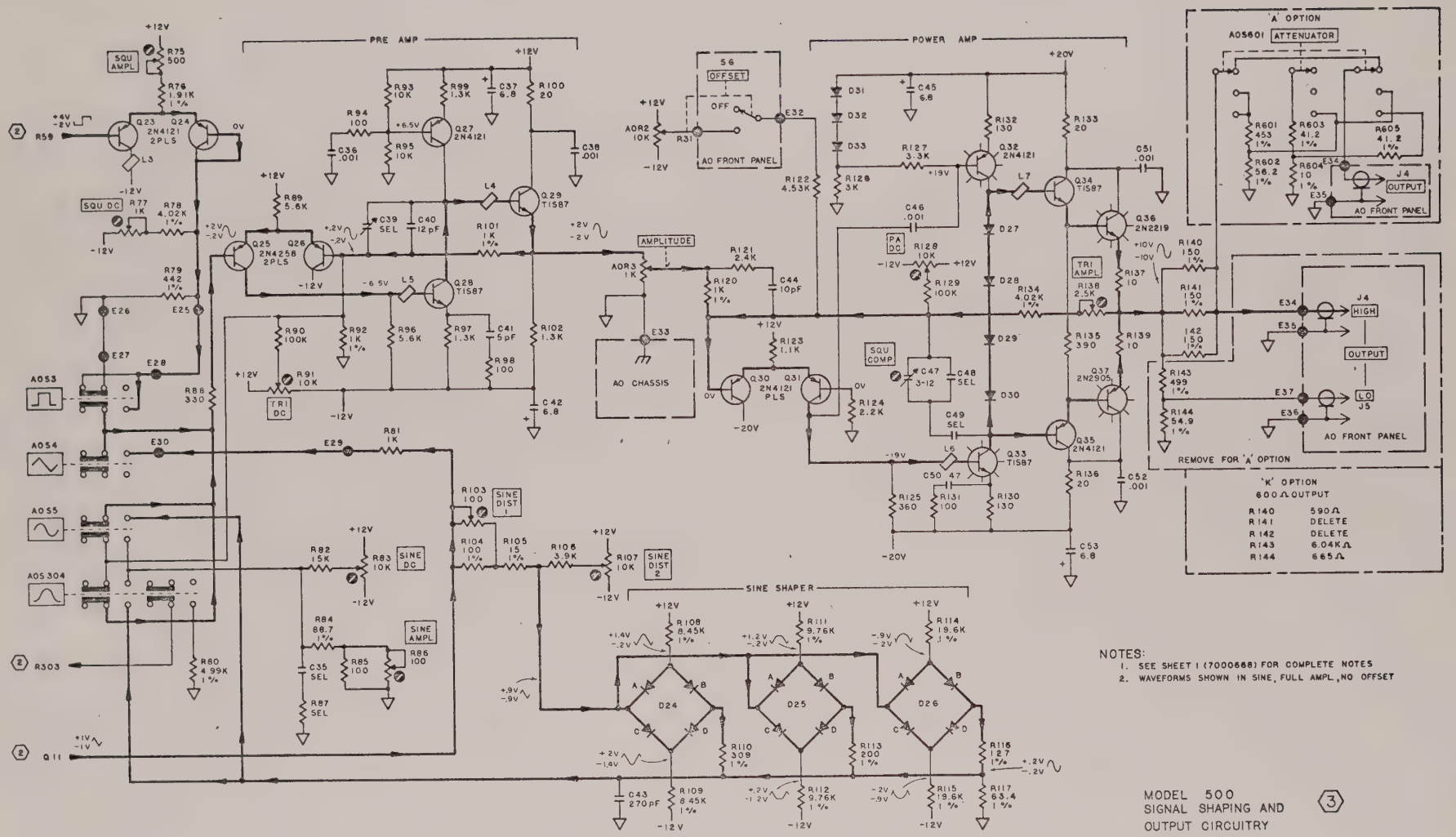
1) $\frac{V_1}{V_2} \sim \frac{\text{SWEEP RUN}}{\text{SWEEP STOP}}$

MODEL 500
POWER SUPPLIES
AND VCF CONTROL
7000668 REV B



NOTES:
1. SEE SHEET 1 (7000668) FOR COMPLETE NOTES
2. VOLTAGES:
   EXCEPT 'L' OPTION
   1) $\frac{V_1}{V_2}$: $\frac{\text{START FREQ AT 5.0}}{\text{START FREQ AT 0}}$
   2) WAVEFORMS SHOWN IN RUN MODE
   'L' OPTION
   1) $\frac{V_1}{V_2}$: $\frac{\text{MAN RELEASED}}{\text{MAN DEPRESSED}}$
   MODE IN GATE

MODEL 500
GENERATOR LOOP
AND LOCKOUT
7000669 REV A



NOTES:
1. SEE SHEET 1 (7000668) FOR COMPLETE NOTES
2. WAVEFORMS SHOWN IN SINE, FULL AMPL., NO OFFSET

MODEL 500
SIGNAL SHAPING AND
OUTPUT CIRCUITRY
7000670 REV A

SECTION 7

ADDENDA

MP MASTER
MA27907